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INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

Enlarged Meeting of the Permanent Commission at Lisbon
(1st to 4th June, 1949.)

Summary of sectional proceedings.

SECTION I. — Way and Works.

QUESTION I.

a) Mechanisation of the maintenance and renewal of the permanent way.

b) Recent improvements relating to reinforced concrete and prestressed concrete sleepers. Results obtained.

c) Recovery and strengthening of metal bridges that have reached the theoretical limit of safety.

Preliminary documents.

Report, Question I, *a*) *(Belgium and Colony, Bulgaria, Denmark, Spain, Finland, France and Colonies, Greece, Hungary, Italy, Luxemburg, Norway, Netherlands and Colonies, Poland, Portugal and Colonies, Rumania, Sweden, Switzerland, Czechoslovakia, Turkey and Jugoslavia)*, by L. MUCHERIE, (See *Bulletin* for January 1949, p. 1.)

Report, Question I, *b*) *(same countries as above)*, by GONON. (See *Bulletin* for March 1949, p. 153.)

Report, Question I, *c*) *(same countries as above)*, by CASSÉ. (See *Bulletin* for February 1949, p. 85.)

Report *(America, Great Britain, Dominions, Protectorates and Colonies, China, Egypt and India)*, by V. A. M. ROBERTSON. (See *Bulletin* for December 1948, p. 727.)

Special report by J. Ch. BOGARIM. (See *Bulletin* for May 1949, p. 333.)

SECTIONAL DISCUSSION.

Meeting held on 2nd June 1949.

Mr. Robert LÉVY, *Directeur, Chef du Service technique des Installations fixes de la Société Nationale des Chemins de fer français, in the Chair.*

THE PRESIDENT opened the Meeting at 9.30 a. m. and welcomed the delegates. He then proceeded with the installation of the Bureau of the Section. On behalf of the Permanent Commission, he proposed :

as *Vice-Presidents :*

Mr. C. LUCCHINI, Directeur général des Chemins de fer fédéraux suisses, and

Mr. A. M. DE CAMPOS HENRIQUES, Sous-Directeur de la Compagnie des Chemins de fer portugais;

as *Principal Secretary :*

Mr. J. DUBUS, Ingénieur en chef de la Société Nationale des Chemins de fer belges, and Assistant Secretary of the International Railway Congress Association;

as *Secretaries :*

Mr. J. BRECHOT, Ingénieur à la Société Nationale des Chemins de fer français,

Mr. E. CONSTANT, Engineer, Personal assistant to Chief Civil Engineer, Southern Region, British Railways, and

Ing. J. PERESTRELO GUIMARAIS, Sous-Chef de service à la Compagnie des Chemins de fer portugais.

— *The Meeting approved these appointments.*

THE PRESIDENT then read the first point on the agenda, as follows :

a) Mechanisation of the maintenance and renewal of the permanent way.

THE PRESIDENT thanked Mr. José Chedas BOGARIM, the Special Reporter, to have with great care and thorough knowledge brought out the main points of the reports and then requested Mr. DUBUS and Mr. CONSTANT to read out in turn the text of the Summaries of the Special Report.

Summary I :

1. In most countries, the use of mechanical equipment is not yet general, and is only in the experimental stage.

Mr. TAYLOR THOMPSON *(British Railways)* stated that in Great Britain the experimental stage as far as the mechanisation of renewals was concerned had already been passed : at the present time more than 50 % of this work was done by mechanical means.

M. DONIZEAU *(Soc. Nat. des Chemins de fer français)* stated that as far as France was concerned the experimental stage had likewise been passed and recalled that mechanical methods of renewal had been in use in his country since 1927.

M. GONON *(Soc. Nat. des Chemins de fer français)* stated that as far as the removal and cleaning of ballast prior to renewals was concerned there was a tendency in France, especially on heavily

worked lines to standardise mechanical methods due to the shortage of manpower. He estimated that 80% of ballast renewals was carried out by mechanical means.

The President resumed the discussion and stated that the experimental stage had undoubtedly been passed as far as the mechanisation of renewals was concerned, and that the mechanisation of maintenance was well advanced. He suggested to Mr. Bogarim and to the delegates of the Section that the text of Summary I should be modified as follows :

« The use of mechanical plant is not yet general, but in certain countries it has already passed the experimental stage for renewal work and in some cases even for maintenance. »

— This text is adopted.

Summary 2 :

2. Important economic advantages can be obtained by the use of such methods for the maintenance and renewal of the track, and these should be increased in the future when more experience is available.

The President proposed that the matter could be better examined by differentiating between renewals and maintenance : he asked the members for their opinions on the advantages likely to result from the application of mechanised methods in each case.

Mr. Donizeau stated that in France they had studied the problem of mechanising maintenance gangs and this presented certain difficulties : he considered that daily maintenance could often be carried out to advantage by small gangs with improved hand tools : this advantage was clearly realised, especially in the case of lines with a large number of level crossings.

Mr. Renda *(Ch. de fer de l'Etat italien)* stated that on the Italian Railways major maintenance works were carried out by contractors, whereas minor day-to-day work was undertaken by railway personnel.

Mr. Taylor Thompson agreed with the previous remarks and emphasised again the importance of a scientific organisation of works in order to obtain the maximum output from the machines employed.

Mr. Gonon said that fundamentally mechanisation of maintenance — other than mechanical tamping — was based on a small number of operations which, generally speaking, were concerned largely with the fittings and connections to the sleepers.

Mr. Lucchini, *Vice-President (Chemins de fer fédéraux suisses)* was of the opinion that the development of mechanisation should be carried as far as possible : he warned, however, that this mechanisation would necessitate considerable expenditure.

The President expressed the opinion that as far as maintenance was concerned, provided it was not a question of extensive work on large numbers of sleepers and fastenings, the small specialist gang with the best type of hand tools was the simplest solution. He asked the opinion of Mr. Robertson *(Reporter)* on this subject.

Mr. ROBERTSON answered that in England and in the U. S. A., in principle, small portable power tools were preferred for maintenance. The factors contributing to the adoption of mechanical methods were as follows :

— lack of man-power;

— reduction of working hours, paid holidays, etc.;

— general economic situation (increased salaries, etc.).

THE PRESIDENT then suggested to Mr. BOGARIM *(Special Reporter)* that the text of Summary 2 should be modified as follows :

« The use of mechanical methods undoubtedly presents economic advantages in carrying out renewal work and for removing and cleaning ballast. It is equally advantageous for smaller repairs, particularly the maintenance of sleepers and fastenings, provided the work is of sufficient extent to justify the employment of specialised gangs. »

Summary 3 :

3. In addition to economic advantages, the use of mechanical equipment also results in appreciable technical advantages.

The work is often more uniform, better and more lasting, compared with manual work; the time taken for certain operations is shortened, which is of great importance when the line is only available for a short period; the work is less fatiguing for the staff. It is also possible to introduce new maintenance methods, such as grinding the rails, building up the ends of rails and crossings by welding, etc.

— No comments were made and this text was adopted.

Summaries 4 and 5 :

4. To obtain a high standard of work and the best output from the equipment, it should only be used by specialist staff.

5. To obtain the best output from the staff and mechanical equipment, it is necessary to make a detailed study of the organization of the work.

A discussion took place between Messrs. JULIEN *(Ministère des Travaux Publics et des Transports, France)*, BOGARIM, ROBERTSON and RENDA, regarding the interpretation to be placed on the term « specialist staff » : it was agreed that this applied both to railway staff and to contractors staff, where applicable.

Mr. TAYLOR THOMPSON put forward a suggestion — adopted by the Section — that Summaries 4 and 5 could with advantage be combined in one single Summary to be numbered 4.

Mr. DONIZEAU stated next that the word « trained » was preferable to « specialist » since complete « specialisation » of staff could not be anticipated. On the contrary it would be desirable to consider the creation of a special department for the maintenance of the machines themselves.

Mr. DE CAMPOS HENRIQUES, *Vice-President (Compagnie des Chemins de fer portugais)* returned to the question of the interpretation to be placed on the expression « specialist staff » which, on his system, could be applied only to railway personnel : he agreed, however, to the word « trained » instead of « specialist ».

THE PRESIDENT resumed the discussion and emphasised the importance of employing on mechanised work small, well

trained gangs, each for a particular part of the work : in this case the problem of training staff should be carefully investigated. He suggested the following wording for Summaries 4 and 5 combined :

« 4. To obtain a good output from both men and machines on work where either mechanical plant or a large number of modern hand tools are used, it is most necessary to examine in the fullest detail possible the organisation of the work and its subdivision into well defined tasks each one allocated to a particular gang. »

Mr. Renda stated that the use of mechanical plant must not be considered solely from the technical aspect : it is desirable also to examine the effect on the Operating Department.

Mr. Leduc *(Soc. Nat. des Chemins de fer français)* agreed with the opinion of Mr. Renda and emphasised the importance of being able to obtain from the Operating Department sufficiently long possessions to enable the Permanent Way Department to employ mechanical equipment with advantage.

A discussion then took place between Messrs. Robertson, Taylor Thompson, Boucqué *(Soc. Nat. des Chemins de fer belges)* and Leduc on the possibility of obtaining such possessions from the Operating Department.

Mr. Boucqué, in agreeing that such possessions are difficult to obtain suggested that the Summary should be rephrased with a view to drawing attention to the importance of obtaining sufficiently long possessions so that work could be carried out under optimum conditions.

The President then suggested the following new Summary 5 and this was adopted :

« The maximum output from plant for removing and cleaning ballast and for relaying permanent way can be obtained when long intervals between the passing of trains can be obtained. The practice enables renewal work to be accelerated, reduces the delay in carrying out such works on a particular section of line and in particular reduces the expenditure (personnel and material employed on each section of the work, cost of supervision and control, cost of slowing down trains, etc.). »

Symmary 6 :

6. In view of the experimental and frankly evolutionary stage of the matter in most countries, it is not possible to formulate any definite summaries regarding the type of mechanisation most to be recommended nor the types of machines most suited to the different operations.

After a short discussion the delegates agreed to adopt this Conclusion, with the sole proviso that the word « experimental » be deleted.

Summary 7 :

7. The generalisation of mechanical methods in the maintenance and renewal of the track is to be recommended in view of the technical and economical advantages made possible by their rational application.

Mr. Boucqué expressed the opinion with regard to the general adoption of mechanisation that this presented not only technical and economic advantages but must be considered from the social aspect : by making work easier mechanisation made

it possible to recruit man-power which is difficult to obtain.

Mr. LUCCHINI and other delegates, were fully in agreement with Mr. BOUCIQUÉ.

THE PRESIDENT requested Mr. BOUCIQUÉ to draft a summary to include a reference to the social aspect.

This summary to be numbered 7.

In addition following a statement by Mr. TAYLOR THOMPSON, the PRESIDENT requested the former to draft a Summary 8 referring to the desirability of providing wide cesses during the construction of new lines and of improving these on existing lines, such cesses would facilitate the use of mechanical plant.

THE PRESIDENT in conclusion proposed the adoption of a ninth conclusion to be drafted in the following terms :

« The application of scientific methods of organisation of work with the use of mechanical plant or hand tools for renewal and maintenance of permanent way, with particular reference to reducing the difficulty of the work and increasing the output of the personnel is to be recommended. »

— This summary is adopted and the Section went on to Question I, *b*).

b) Recent improvements relating to reinforced concrete and prestressed concrete sleepers. Results obtained.

Summary 1 :

1. The use of reinforced concrete sleepers is still very limited and merely in the experimental stage.

Mr. LEDUC considered that in England the use of reinforced concrete sleepers had passed the experimental stage and wished to have some information on this point.

Mr. ROBERTSON considered that only prestressed sleepers should be considered as being in an experimental stage since they had only been employed for 4 or 5 years.

Mr. GONON *(Reporter)* added that in France also the experimental stage had been passed : he agreed with Mr. ROBERTSON that the words « in an experimental stage » should be deleted and suggested that it be stated that the use of reinforced concrete sleepers is « still limited ».

Summary 1 was adopted in this form.

Summary 2 :

2. From the experience already acquired it can be concluded that the behaviour of reinforced concrete sleepers on lines with fast traffic has not been satisfactory. For this reason, their use has been limited to secondary lines where there is little traffic, or to sidings.

Mr. GONON considered that in the form proposed this conclusion was unduly severe : he mentioned the satisfactory use of « Vagneux » sleepers on the line between Riom and Vichy, and on the Algerian system where trains reach speeds of 80 m. p. h. On lines with both fast and heavy traffic, concrete sleepers have not, however, given satisfaction.

Mr. LUCCHINI asked that it be stated specifically in the text that it is the practice to use concrete sleepers in certain countries only : Switzerland in particular does not use them for secondary lines.

Mr. Taylor Thompson asked that it be specified whether it was a question of ordinary or pre-stressed concrete sleepers.

The President proposed that the first sentence be amended as follows :

« From experience already gained as far as non pre-stressed concrete sleepers are concerned, it can be concluded that the behaviour of these sleepers on lines with important traffic is not satisfactory. »

— This amendment was adopted.

The second sentence was also amended as follows :

« For this reason certain systems limit their use to secondary lines with light traffic or to sidings. »

Summary 3 :

3. The combined type of reinforced concrete sleeper, consisting of two blocks connected together by tie beams, has proved to be the better able to stand up to service conditions on such lines.

Mr. Gonon basing his case on the Algerian Railway suggested that the expression « on lines of this category » be deleted.

Mr. Taylor Thompson considered that sleepers consisting of two blocks joined by a tie-bar were only suitable for secondary lines and suggested that no amendment was necessary.

The President whilst wishing to satisfy Mr. Gonon and at the same time to take into consideration Mr. Taylor Thompson's statement proposed the following rewording of Summary 3 :

« The systems which still utilise non pre-stressed concrete sleepers prefer the mixed type consisting of blocks joined by tie-bars. »

Summary 4 :

4. Prestressed concrete sleepers offer greater resistance to impact stresses than the standard types of reinforced concrete sleeper. From the results obtained during the trials already carried out and now in hand, it can be expected that they will give good results on lines with heavy, fast traffic, especially if they are fitted with the up-to-date type of elastic fastening.

The present tendency of research work is to endeavour to improve still further these types of sleeper, which appear to justify the high hopes placed upon them.

Mr. Julien considered that it would be more satisfactory to replace the expression « on lines with fast and heavy traffic » by the words « on lines with important traffic. »

Mr. Taylor Thompson agreed with this opinion.

Mr. Robertson stated that impact tests in laboratories had given good results, but that it was still premature to say that this was confirmed by actual use on the lines.

Mr. Leduc suggested the use of the expression « it can be expected » by « it can be hoped ».

Mr. Boucique suggested the word « very » in the expression « very satisfactory » be deleted and that the final phrase be confined to « fitted with elastic fastenings ».

The President after agreeing with

Mr. ROBERTSON proposed the following wording for Summary 4 :

« Prestressed concrete sleepers offer greater resistance to impact effects than do ordinary reinforced concrete sleepers.

« Having regard to the results obtained in laboratory tests, it can be hoped that they will give satisfactory results on lines with important traffic, and specially if they are fitted with elastic fastenings. »

— Adopted.

Summary 5 :

5. The use of the ordinary type of reinforced concrete sleeper on lines equipped with track circuits or electrified lines gives rise to serious difficulties on account of their insufficient resistivity.

It is possible that the investigations now being carried out will find a satisfactory solution to this problem in the near future.

An exchange of views took place between Messrs. GONON, ROBERTSON and LUCCHINI on the use of reinforced concrete sleepers on electrified lines and on the lines with track circuits.

THE PRESIDENT in order to take into consideration the ideas put forward, suggested for the approval of the delegates a new text as follows :

« 5. Improvements seem to be necessary in order that reinforced concrete sleepers may be used on electrified lines and on lines with track circuits. »

— Adopted.

Summary 6 :

6. The method of fastening the rail to the sleeper is very important as far as the protection of the latter is concerned.

The types of fastening which have proved the most satisfactory are :

— indirect fastening, with separate fastening of the rail and the bearing plate, without any intermediate elastic plate;

— a completely elastic fastening (grooved rubber plate and elastic clip) with bolt-coachscrew screwed into a Thiollier fitting.

— Adopted.

Summary 7 :

7. If the use of reinforced concrete sleepers is to prove economical compared with that of wood sleepers, their manufacturing costs must be greatly reduced from the present level, which can only be done by mechanisation of the manufacturing processes.

Mr. JULIEN considered that no useful purpose was served by stating that the cost of manufacture could be reduced by mechanisation of the manufacturing processes.

THE PRESIDENT asked for the views of the British delegates who were of the same opinion as Mr. JULIEN.

The last part of the sentence in question was therefore deleted and the Summary adopted.

Summary 8 :

8. It would be of interest to carry out tests regarding the use of long welded rails in conjunction with that of reinforced concrete sleepers in order to determine the technical possibilities of this method and its financial repercussions.

— No comments were made and this text was adopted.

— The rest of the discussion was put off till the following day and the Meeting adjourned at 12.30 p. m.

Meeting held on the 3rd June 1949.

Mr. Robert Lévi *in the Chair.*

The President opened the meeting at 9.30 a. m. and proceeded to read over the Conclusions as re-drafted during the meeting of the 2nd June, regarding the points *a)* and *b)* of Question I.

a) **Mechanisation of the maintenance and renewal of the permanent way.**

Summary 1 :

The text is adopted in the form approved at the previous meeting :

« 1. The use of mechanical plant is not yet general in all countries but in certain countries it has already passed the experimental stage for renewal work and in some cases even for maintenance. »

Summary 2 :

Mr. Renda proposed that the word « smaller » should be deleted and Mr. Donizeau suggested that « special gangs » should be substituted for «specialist gangs» the members agreed and Summary 2 was adopted in this new form, as hereafter :

« 2. The use of mechanical methods undoubtedly presents economic advantages in carrying out renewal work and for removing and cleaning ballast. It is equally advantageous for maintenance, particularly that of sleepers and fastenings, provided the work is of sufficient extent to justify the employment of special gangs. »

Summary 3 :

Messrs. Lévi and Leduc requested a minor modification and suggested replacing « It is also possible to introduce... » by « It is possible to introduce or to develop further... » The delegates agreed and the text adopted is as follows :

« 3. In addition to economic advantages, the use of mechanical equipment also results in appreciable technical advantages.

« The work is often more uniform, better and more lasting, compared with manual work; the time taken for certain operations is shortened which is of great importance when the line is only available for a short period; the work is less fatiguing for the staff. It is possible to introduce or develop further new maintenance methods such as grinding the rails, building up the ends of rails and crossings by welding, etc. »

Summary 4 :

The following text is adopted :

« 4. To obtain a good output from both men and machines on work where either mechanical plant or a large number of modern hand tools are used, it is most necessary to examine in the fullest detail possible the organisation of the work and its subdivision into well defined tasks, each one allocated to a particular gang. »

Summary 5 :

A discussion took place on the question of redrafting this Summary. Mr. Taylor Thompson asked that the text should emphasise the advantages which the Operating Department could obtain by allowing longer possessions.

Mr. BOUCIQUÉ amplified Mr. TAYLOR THOMPSON's proposal and emphasised the advantages to all Departments.

THE PRESIDENT then proposed that, in order to meet the requirements of these last speakers, the phrase « reduces the expenditure » should be amended to « reduces the expenditure of all Departments, and in particular the cost of reduced speeds ».

Further Mr. RENDA obtained the agreement of his collegues to amending the first sentence as follows : « The maximum output from mechanical plant for removing and cleaning ballast, for removing and relaying track, can be obtained when... ».

— The new text adopted is as follow :

« 5. The maximum output from mechanical plant for removing and cleaning ballast and for removing and relaying track can be obtained when long intervals between the passing of trains are available. This practice enables renewal work to be accelerated, reduces the delay in carrying out such works on a given section of line and in particular reduces the expenditure of all departments, especially the cost of « reduced » speeds. »

Summary 6 :

The following text approved at the previous meeting is adopted :

« 6. In view of the frankly evolutionary stage of the matter in most countries it is not possible to formulate any definite summaries regarding the type of mechanisation most to be recommended nor the types of machines most suited to the different operations. »

Summary 7 :

THE PRESIDENT read Summary 7 drafted at his request by Mr. BOUCIQUÉ :

« 7. In general the use of mechanical plant greatly improves conditions of work : it constitutes therefore a factor in social progress which is not to be neglected.

« Since fewer men are required and to a large extent heavy manual work avoided, mechanisation of renewals and maintenance of the permanent way facilitates the recruiting of staff for permanent way and contract works, especially in industrial areas. »

— The wording of this Summary was adopted.

Summary 8 :

Mr. TAYLOR THOMPSON made available the Summary which he had to redraft during the previous meetings :

« 8. It is desirable in future in the case of new railway construction or when modifying existing lines to provide large cesses to facilitate the use of mechanical equipment and generating plant. »

This Summary was adopted without discussion.

Summary 9 :

Mr. BOUCIQUÉ requested that after the phrase « ... is to be recommended » a sentence to the effect that « ... on account of the mechanical, economic and social advantages which this offers » be included

Mr. TAYLOR THOMPSON suggested that the last sentence should be completed by

« ...together with the improved quality of the work ».

— These two amendments were approved and the text adopted is as follows :

« 9. The application of scientific methods of organisation of work with the use of mechanical plant or hand tools for renewal and maintenance of the permanent way with particular reference to reducing the difficulty of the work and increasing the output of the personnel is to be recommended on account of the technical, economic and social advantages which this offers. »

The Section then proceeded to read the Summaries approved during the Meeting of the 2nd June, regarding point *b* :

b) **Recent improvements relating to reinforced concrete and prestressed concrete sleepers. Results obtained.**

Summary 1 :

The following text is adopted without alteration :

« 1. The use of concrete sleepers is still limited. »

Summary 2 :

This summary altered previously is adopted.

« 2. From experience already gained as far as non pre-stressed concrete sleepers are concerned, it can be concluded that the behaviour of these sleepers on lines with important traffic is not satisfactory. For this reason certain systems limit their use to secondary lines with light traffic or to sidings. »

Summary 3 :

Two small modifications proposed by Mr. Gonon and the President were adopted without discussion.

The former proposed the deletion of the word « still » and the latter proposed the addition of « in general » before « prefer ».

— The summary is therefore adopted, as given hereafter :

« 3. The systems which utilise non prestressed concrete sleepers in general prefer the mixed type consisting of blocks joined by tie-bars. »

Summary 4 :

This Summary was adopted after the Section had accepted an amendment put forward by Mr. Julien who proposed the addition of the word « even » after « good results ».

— The wording is as follows :

« 4. Pre-stressed concrete sleepers offer greater resistance to impact effects than do ordinary reinforced concrete sleepers. Having regard to the results obtained in laboratory tests it can be hoped that they will give satisfactory results even on lines with important traffic, and especially if they are fitted with elastic fastenings. »

Summary 5 :

The following wording is adopted :

« 5. Improvements seem to be necessary in order that reinforced concrete sleepers may be used on electrified lines and on lines with track circuits. »

Summary 6 :

Mr. GONON suggested that the drafting of the final paragraph of this Conclusion should be in more general terms.

THE PRESIDENT and Mr. LEDUC shared this view as did the rest of the delegates.

THE PRESIDENT obtained agreement to the following amendment :

Last paragraph to read :

« — a completely elastic fastening (elastic clip and non rigid packing). »

— The adopted wording for Summary 6 is hereafter :

« 6. The method of fastening the rail to the sleeper is very important as far as the protection of the latter is concerned.

« The types of fastening which have proved the most satisfactory are :

« — indirect fastening with separate fastening of the rail and the bearing plate, without any intermediate elastic plate;

« — a completely elastic fastening (elastic clip and non-rigid packing). »

Summaries 7 and 8 :

A discussion took place as to whether or not Summary 8 should be retained, or whether it should be combined with Summary 7. Messrs. TAYLOR THOMPSON and ROBERTSON considered that the item dealt with in Summary 8 was outside the scope of this question. Messrs. GONON and LEDUC explained why in their opinion this item was relevant.

THE PRESIDENT resumed the discussion and emphasised that, in Summary 8 it was in fact only a possibility that the use of long welded rails requiring heavy sleepers might lead them to visualise the use of reinforced concrete sleepers under suitable conditions.

The Section decided, as proposed by the PRESIDENT, to substitute the words « to give real economic advantages » for « to prove economical » in the first sentence of Summary 7.

Mr. LUCCHINI considered that it was most necessary to make reference to the comparative costs of steel sleepers largely used in his country : consequently he requested that the words « wood sleepers » should be amended to « wood and steel sleepers. »

Summary 7 was adopted with the above amendments, and Summary 8 was adopted without alteration.

The wording of Summaries 7 and 8 is as follows :

« 7. If the use of reinforced concrete sleepers is to prove economical compared with that of wood and steel sleepers their manufacturing costs must be greatly reduced below the present level. »

« 8. It would be of interest to carry out tests regarding the use of long welded rails, in conjunction with that of reinforced concrete sleepers, in order to determine the technical possibilities of this method and its financial repercussions. »

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— After an interruption of a few minutes, the Section proceeded to the examination of the Summaries of Question I, *c)* on the agenda.

c) **Recovery and strengthening of metal bridges that have reached the theoretical limit of safety.**

The President asked for the Summaries of Mr. Bogarim, the Special Reporter, to be read.

Summary 1 :

1. The principal reason why metal railway bridges have to be replaced or strengthened is the increase in the rolling loads.

Mr. Cassé *(Reporter)* wished to see the words « ... the principal reason:... » replaced by « the most frequent cause... »

This proposed amendment was the subject of a discussion between several members, amongst them Messrs. Taylor Thompson, de Campos Henriques and Julien, who emphasised the fact that in addition to the Summary 1 there are other reasons for replacing or strengthening a bridge (age, corrosion, etc.).

The President proposed the following re-drafting of this Summary which was then adopted by the delegates.

« 1. The renewal or strengthening of a metal bridge is generally necessitated on account of increased rolling loads and also by increased speeds, or on account of reduced sections due to corrosion. »

Summary 2 :

2. The strength of existing metal bridges is determined by theoretical calculations, often checked by direct measurement of the stresses on the bridge in question.

Mr. Cassé proposed the addition of the following sentence :

« The permissible stresses for existing structures are generally appreciably higher than those allowed for the construction of new works. »

This proposal is adopted and the wording of Summary 2 is therefore as follows :

« 2. The strength of existing metal bridges is determined by theoretical calculations often checked by direct measurement of the stress on the bridge in question.

« The permissible stresses for existing structures are generally appreciably higher than those allowed for the construction of new work.s »

Summary 3 :

3. Each case of a bridge which has reached its theoretical limit of safety should be examined separately, in its own proper place, in order to determine the best technical and economical solution.

The solution considered the most suitable by the majority of Administrations, and that most often adopted, is the complete renewal of the structure.

This wording leads to a discussion with a view to determining whether it would not be better, as proposed by Mr. Cassé, to include the last paragraph at the end of the Summaries, in the form of a new Summary 9.

It was finally decided not to adopt this course, but as proposed by the President, to add to the first paragraph the following words «... and the relative merits of strengthening as opposed to renewal should be compared. ».

Mr. Renda obtained the approval of the Section to the deletion of the word « theoretical ».

The members then adopted Summary 3 in the following form :

« 3. Each case of a bridge which has reached its limit of safety should be examined separately, in its own proper place, in order to determine the best technical and economical solution and the relative merits of strengthening as opposed to renewal should be examined. »

Summary 4 :

4. The use of bridges from other lines, when circumstances lend themselves thereto, is an interesting and economical way of replacing bridges, but this method is usually limited to small and medium sized spans of girder type bridges.

Mr. CASSÉ stated that the drafting of this Summary did not bear any very close relation to the text of the reports since the re-use of bridges is not limited to the case of plate girder structures; he quoted an example of the application of this method to « trellis » girders.

The delegates agreed to the following new wording :

« 4. The re-use of complete bridges from other lines when circumstances allow can be an interesting and economic procedure. »

Summaries 5 and *6 :*

5. The strengthening of sections by riveting is the method most generally used, but it cannot be recommended when the addition of supplementary parts involves removing the rivets from important fastenings.

6. Strengthening by welding is a practical and economical method, not yet widely used, but the work must be very carefully carried out if confidence is to be placed in the method.

Its use on old iron bridges is not recommended.

Mr. RENDA made it clear that this summary 5 deals with strengthening by riveting in situ or shops.

Mr. TAYLOR THOMPSON drew the attention of his colleagues to the order in which Summaries 5 ansd 6 were arranged. In England, preference was given to strengthening by welding and he asked whether it would not be possible to change the order of these Summaries.

The Section agreed to accept this change in the arrangement of the Summaries.

Mr. CASSÉ then considered the wording of the former Conclusion nº 6 and emphasised the importance of insisting on the precautions to be taken when welding work is carried out.

Mr. TAYLOR THOMPSON supported by his colleague Mr. ROBERTSON stated that strengthening by welding does not present difficulties and it should not be necessary to emphasise unduly the precautions to be taken.

Mr. CASSÉ wished only to draw attention to the necessity for the welders to be well trained.

THE PRESIDENT then proposed the new wording hereafter for the former Summary 6, which becomes the new Summary 5.

« 5. Strengthening by welding is an economic and practical procedure which is being adopted to an increasing extent ; it requires to be carefully carried out.

« The use of this method for old iron bridges requires a procedure adapted to the nature of the metal. »

The former Summary 5, now to be numbered 6, was adopted after the addition of the word « still » following « The strengthening of sections by riveting is... » and is worded as follows :

« 6. The strengthening of sections by rivetting is still the method most generally used, but it cannot be recommended when the addition of supplementary parts involves removing the rivets from important fastenings. »

Summary 7 :

7. The strengthening of bridges by adding new framework, building new supports, etc., can be recommended when the main girders have to be reinforced, as it makes it possible to strengthen the bridge without modifying the old structure.

Mr. Boucqué suggested a minor simplification of the text of this Summary.

Mr. Robertson shared this view and the President obtained the agreement of the delegates to the following wording :

« 7. The strengthening of bridges by the addition of new framework, construction of new supports, etc., without modifying the old structure is recommended. »

— Adopted.

Summary 8 :

8. Strengthening by means of reinforced concrete has given good results, so it may be stated that this method represents an interesting solution.

Mr. Renda asked that the precise meaning of this Summary be explained.

Mr. Robertson appreciated this request : he wished to know whether it was a question of strengthening decks, or main girders.

Mr. Cassé gave the required explanation. The President asked Mr. Björk *(Chemins de fer de l'Etat suédois)* to say a few words to the meeting on the interesting results obtained in Sweden.

Mr. Björk stated that the use of reinforced concrete for strengthening bridges gave quite satisfactory results; but that nevertheless it was questionable whether at the present time this procedure would again be adopted. In practice cracking had occurred in the concrete and it was feared that should this increases the reinforcement might be affected.

Mr. Cassé obtained the agreement of the Meeting to the following wording of the last Summary :

« 8. Strengthening certain bridges by reinforced concrete has given good results. In recent applications of this method simple exterior shapes have been preferred and effective bonding between steel and reinforced concrete has been sought. »

— Adopted.

The President thanked the Reporters and the Delegates for the very useful work they have done.

Replying on behalf of the Meeting, Mr. Robertson thanked the Chairman for presiding so ably over these proceedings dealing with questions of such particular importance for the Railways.

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— The Meeting ended at 12.40 p. m.

Note. — *The complete text of the Summaries relating to Question I is reproduced further on page 668 to 670.*

SECTION II. — Locomotives and rolling stock.

[621 .335]

QUESTION II.

Electric locomotives for fast trains (75 m.p.h. and over). Discussion of adopted and projected types.

1) **Arrangement of the axles.**
2) **Type of axle drive :**
   a) **motor suspended from the nose;**
   b) **flexible transmission.**
3) **Electric motor characteristics.**
4) **Braking.**

Preliminary documents.

Report *(Austria, Belgium and Colony, Bulgaria, Denmark, Czechoslovakia, Finland, France and Colonies, Greece, Hungary, Italy, Luxemburg, Norway, Netherlands and Colonies, Spain, Rumania, Sweden, Switzerland, Turkey and Yugoslavia)*, by Messrs. Dr. E. Meyer and Ch. Sthioul. (See *Bulletin*, April 1949, p. 271.)

Report *(America, Great Britain, Dominions, Protectorates and Colonies, India, China and Egypt)*, by Mr. G. A. Dalton. (See *Bulletin*, December 1949, p. 800.)

Special report, by Mr. A. d'Arbela. (See *Bulletin*, May 1949, p. 352.)

SECTIONAL DISCUSSION.

Meeting held on June 2nd 1949.

Sir Cyril Hurcomb, *Chairman of the British Transport Commission, in the Chair.*

The President opened the Meeting at 9.30 a. m. and installed the Bureau. On behalf of the Permanent Commission he proposed :

as *Vice-Presidents :*

Mr. F. Q. den Hollander, President of the Netherlands Railways;

Mr. A. da Silveira Bual, Directeur de la Société Estoril;

as *Principal Secretary :*

Mr. Uytborck, Ingénieur à la Société Nationale des Chemins de fer Belges and Assistant-Secretary to the International Railway Congress Association;

as *Secretaries* ;

Mr. H. Bonnefon, Inspecteur divisionnaire de 1re classe, Service Technique du Matériel et de la Traction à la Société Nationale des Chemins de fer français;

Mr. Eyre A. W. Turbett, Assistant Chief Mechanical Engineer, Southern Region, British Railways,

Mr. J. Lopes Montoya, Ingénieur adjoint du Matériel et de la Traction à la Compagnie des Chemins de fer Portugais.

— *The Section approved of these appointments.*

The President expressed his thanks and proceeded with the agenda. He called upon Mr. d'Arbela, *Special Reporter*, who, after a brief summary of his report, read in turn the Summaries :

Summary 1 :

1. Concrete achievements show that the construction of locomotives for speeds running up to 160-180 km./h. (100-112 m.p.h.) is possible. The principal and most severe technical restrictions to the adoption, for normal services, of speeds of this kind arise from the layout of the lines and signalling requirements, in conjunction with the minimum number of stops.

The President opened the discussion by asking the delegates for their observations regarding this Summary.

Mr. Nouvion *(Soc. Nat. des Chemins de fer français)* remarked that the formula $a\sqrt{R}$ which gives the maximum permissible speeds on the radius of curves appeared, according to the experience of the S. N. C. F., insufficient, bearing in mind the limitations imposed by the curves. It is also necessary to consider the question of super-elevation. In France a maximum of 150 mm. lack of super-elevation is allowed and this must not be exceeded ; from a certain radius of curve, this restricts it further than the formula $a\sqrt{R}$.

The President, to give effect to this remark, proposed to add after « the layout of the lines », the words « and super-elevation ».

As no objection to this alteration was raised it was adopted. The wording of this Summary is therefore as follows :

« 1. Concrete achievements show that the construction of locomotives for speeds running up to 160-180 km./h. (100-112 m. p. h.) is possible. The principal and most severe technical restrictions to the adoption, for normal services, of speeds of this kind arise from the layout of the lines, super-elevation, and signalling requirements, in conjunction with the minimum number of stops. »

Summary 2 :

2. The evolution of the mechanical part of locomotives is subject to the influence of predominant conditions on the various Railway systems, which explains certain important differences found between construction in the U. S. A. and in Europe, the former tending towards an arrangement of axles comprising two axle guiding bogies and articulated frames, whereas the latter appear to tend more to locomotives with a total adhesion weight, fitted with motor-bogies having two or three axles.

Mr. Maass *(South African Railways)* asked what was meant exactly by « predominant conditions» .

Mr. D'ARBELA stated that in America higher axle loads and, in consequence, higher drawbar pull than in Europe is permitted, where the tendency is to reduce weight as much as possible, which accounts for these conditions.

Mr. DEN HOLLANDER *(Vice-President), (Netherlands Railways)* stated that in the U. S. A. high speed electric locomotives are approaching more and more the design of Diesel electric locomotives. It can, therefore, be said that the difference between the axle arrangement of American and European locomotives tends to lessen more and more. However, in the U. S. A. they are returning to the motor nose suspension and it will be most interesting to see if this type of suspension is reverted to in Europe.

Mr. MAASS agrees that if the two tendencies were drawing closer together, Summary 2 would soon lose its value.

Mr. NOUVION thought that to compare the two tendencies, it was necessary to bear in mind the track stresses. In America, with nose suspended motors the stresses are comparable with the axle weights. In France, the fully suspended motors could limit the stresses to 40 % of the axle weight. From this aspect the locomotive with a total adhesive weight offers a distinct advantage over a locomotive with rigid frame and guiding bogie. These remarks have been fully confirmed by the trials at 180 km. per hour with a prototype CC locomotive.

Mr. GHINS *(Soc. Nat. des Chemins de fer Belges)* said that even in the U. S. A. it did not seem that the general tendency was to use guiding axles.

THE PRESIDENT suggested that Summary 2 must be modified after this discussion.

The Section agreed and it was decided that the Bureau should submit a new text for this Summary at the next meeting :

Summary 3 :

3. The numerous systems of axle-drive in use appear to be still in a state of evolution, although constructors appear to prefer solutions allowing a certain liberty of movement between the ensemble of the toothed wheels in mesh and the axle or else the motor-shaft.

However, the system called « motor suspended from the nose » does not appear to have been entirely abandoned and is perhaps still capable of improvements which will attenuate its defects.

The first paragraph of this conclusion is adopted.

Mr. GHINS said, regarding the 2nd paragraph, that a large number of high speed modern locomotives with motor nose suspension are in service in Brazil; therefore it cannot be said that this system is about to be abandoned.

Mr. DALTON *(Reporter)*, remarked that the Pennsylvania Railroad were using 2CC2 locomotives with fully suspended motors, while the Paulista Railroad employed 2CC2 locomotives with nose suspension, justifying this difference by the variation in the power of the motors. It would seen, therefore, that the 675 H.P. of the nose suspended motors of the Paulista Railroad had reached the maximum.

Mr. DEN HOLLANDER stated that the choice depended very much on the type of track. The heavier the rail the more motor nose suspension would be adopted.

The President suggested that the second paragraph of Summary 3 should be modified in such a manner as not to indicate that motor nose suspension was likely to be abandoned.

This suggestion was agreed. The Bureau of the Section will redraft a new text for this paragraph and same will be submitted at the next meeting.

Summary 4 :

4. There is no particularity as regards the traction motors used on fast locomotives.

Mr. Dalton proposed to substitute the phrase « special features » for the word « particularity » and this was agreed.

Mr. Nouvion stated that a comparison of motors from the point of view of power and weight per H. P. must bear in mind the difference between the continuous rating and maximum speed.

Mr. d'Arbela remarked that in comparisons of that nature, the question of ventilation would arise.

Mr. Meyer *(Reporter)* considered that the remarks of Messrs. Nouvion and d'Arbela were to the point but were not of such a nature as to modify the text of Summary 4.

Mr. Nouvion considered it was necessary to take special precautions in the construction of nose suspended motors employed on high speed locomotives.

Mr. d'Arbela replied that it was rather a question of the appropriate dimensions of motors than a difference in design.

The President proposed in consequence that the text of Summary 4 should be adopted in the form proposed by the special Reporter.

— Summary 4 is adopted, the wording being as follows :

« 4. There is no special features as regards the traction motors used on fast locomotives. »

Summary 5 :

5. The problem of braking still exists in spite of progress made for a better use of adhesion and friction and appears as the most difficult to solve in view of the great power to be dissipated.

No points being raised, Summary 5 was adopted.

— The meeting rose at 11.30 a. m.

Meeting held on June 3nd, 1949.

Sir Cyril Hurcomb *in the Chair.*

— The meeting opened at 9.30 a. m.

The President asked for the Summaries agreed on the 2nd June to be read as well as the proposals of modification drafted by the Bureau for certain points.

Summary 1 :

Summary 1 modified in accordance with the decision of the previous meeting was read.

No observations being made, Summary 1 was adopted in the following form :

« 1. Concrete achievements show that the construction of locomotives for speeds running up to 160-180 km./h. (100-112 m.p.h.) is possible. The principal and most severe technical restrictions to the adoption, for normal services, of speeds

of this kind arise from the layout of the lines, super-elevation, and signalling requirements, in conjunction with the minimum number of stops. »

Summary 2 :

The new wording hereafter proposed by the Bureau for Summary 2 was read :

« 2. The design of the mechanical portions of locomotives is influenced by the prevailing conditions on the different railway systems; which explains certain important differences which are noticed between the U. S. A. and European methods of construction. American construction tended towards an arrangement of axles with a guiding bogie and articulated frames. The present tendency, however, in all countries tends towards locomotives with total adhesive weight, fitted with motor bogies on two or three axles. »

After an exchange of views between Messrs. MEYER, COX *(Railway Executive, British Railways)*, D'ARBELA, GHINS and NOUVION, it was proposed to add after « The design of the mechanical portions » the words « where the arrangement of axles is concerned ».

Mr. NOUVION drew attention to certain characteristic points concerning the construction of modern high speed locomotives with total adhesive weight and, in particular, on the rigidity of bogie frames, the lack of transverse play between the axles and bogie frames, and the possibility of regulating the centralising forces. The absence of free play is an important characteristic in the progress in the design of high speed locomotives. Formerly, locomotives with total adhesive weight were built but their use in high speed service would have brought about stresses, owing to side play, which would not be permitted on the track.

Mr. D'ARBELA said that the important characteristic of these locomotives appeared to him to be the adoption of lateral and transverse play. The side play of these parts is relevant to the maintenance.

Mr. GHINS agreed with the opinion of Mr. NOUVION.

THE PRESIDENT considered that these special features of construction cannot enter into the summaries which must be kept to a general character. The Section agreed.

Mr. GHINS stated that electric locomotives without guiding bogies need not necessarily have total adhesive weight.

An exchange of views took place between Messrs. GHINS, COX, D'ARBELA, DALTON and MEYER on this point. Mr. GHINS proposed that the last phrase of Summary 2 should be replaced by the following :

« The present tendency, however, in all countries tends towards locomotives fitted with motor bogies on 2 or 3 axles and, in general, with total adhesive weight.

This was adopted and the final wording of Summary 2 is as follows :

« 2. The design of the mechanical portion of locomotives, where the arrangement of axles is concerned, is influenced by the prevailing conditions on the different railway systems; which explains certain important differences which are noticed between the U. S. A. and European methods of construction. American construction tended towards

an arrangement of axles with a guiding bogie and articulated frames. The present tendency, however, in all countries tends towards locomotives fitted with motor bogies on 2 or 3 axles and, in general, with total adhesive weight. »

Summary 3 :

The President recalled that the Bureau had been requested at the previous meeting to redraft the second paragraph of this Summary.

The new proposed text is as follows :

« Motor nose suspension » is still in use and it is even being adopted in certain countries for new stock now being designed. »

The Section agreed to this new text. Therefore, Summary 3 will be altered as hereafter :

« 3. The numerous systems of axle-drive in use appear to be still in a state of evolution, although constructors appear to prefer solutions allowing a certain liberty of movement between the ensemble of the toothed wheels in mesh and the axle or else the motorshaft. *Motor nose suspension is still in use and it is even being adopted in certain countries for new stock now being designed.* »

Mr. Cox suggested that in the new English text for the second paragraph of Summary 3 the words « motor nose suspension » should be replaced by « The nose suspended motor ».

— Adopted.

Summary 4 :

No points being raised with regard to the wording approved at the previous meeting, Summary 4 is therefore as follows :

« 4. There is no special features as regards the traction motors used on fast locomotives. »

Summary 5 :

Mr. Nouvion remarked that the braking at high speed was more difficult on the stock hauled than on the locomotive, where the air brake can be supplemented by electric brakes. Would it be correct to confine this Summary to electric locomotives?

Messrs. den Hollander and Cox while recognising the pertinence of Mr. Nouvion's remark, considered that the text of Summary 5 should remain as at present, bearing in mind that the problem of braking must be considered for the whole train.

Mr. Nouvion agreed with this and Summary 5 was adopted with the following text :

« 5. The problem of braking still exists in spite of progress made for a better use of adhesion and friction and appears as the most difficult to solve in view of the great power to be dissipated. »

The President thanked the Special Reporter, the Reporters and the Delegates for their work and for the part they had taken in the discussions.

Mr. Dalton thanked the President on behalf of the Section for the manner in which he had conducted the meeting.

The Meeting rose at 10.30 a. m.

Note. — The complete text of the Summaries adopted by the Section, relating to Question II is given further on page 671.

SECTION III. — Working.

[656 .225 & 656 .261]

QUESTION III.

Transport of miscellaneous goods.

Concentration in a certain number of selected centres (stations) of miscellaneous traffic, transport by rail between centre-stations, by road or rail between the originating point and the nearest centre-station, and also to the last centre-station near the destination.

Interest of the scheme for the conveyance of goods traffic.

Organisation of the station-centres and of the collection and delivery services.

Financial results of the scheme.

Preliminary documents.

Report *(America, Great Britain, Dominions, Protectorates and Colonies, Burma, China, Egypt, India and Pakistan)*, by P. H. Sarma. (See *Bulletin* for March 1949, p. 209.)

Report *(Austria, Belgium and Colony, Bulgaria, Denmark, Spain, Finland, France and Colonies, Greece, Hungary, Italy, Luxembourg, Norway, Netherlands and Colonies, Poland, Portugal and Colonies, Rumania, Sweden, Switzerland, Czechoslovakia, Turkey and Yugoslavia)*, by G. Moulart. (See *Bulletin* for April 1949, p. 229.)

Supplement to Report, by G. Moulart. (See *Bulletin* for May 1949, p. 375.)

Special report, by Dr. J. Faria Lapa. (See *Bulletin* for May 1949, p. 359.)

SECTIONAL DISCUSSION.

Meeting held on June 2nd 1949.

Mr. Rogerio V. Ramalho, *Directeur Général des Chemins de fer au Ministère des Communications du Portugal, in the Chair.*

— The meeting opened at 9.30 a. m.

The President welcomed the delegates and proposed on behalf of the Permanent Commission the constitution of the Bureau of Section as follows :

as *Vice-Presidents ;*

Mr. G. di Raimondo, Directeur général des Chemins de fer de l'Etat italien, and

Mr. M. Dias Trigo, Chef de la Réparti-

tion à la Compagnie des Chemins de fer Portugais;

as *Principal Secretary ;*

Mr. E. Voordecker, Ingénieur principal à la Société Nationale des Chemins de fer Belges;

as *Secretaries ;*

Mr. J. Delacour, Inspecteur divisionnaire de 1re classe à la Société Nationale des Chemins de fer français;

Mr. J. H. Glendinning, District Engineer, Railway Executive, British Railways, Eastern Region, and

Mr. C. Santos, Ingénieur, Chef de service adjoint à la Division Commerciale de la Compagnie des Chemins de fer Portugais.

— *The Section approved these appointments.*

The President excused the absence of Mr. di Raimondo, whose duties prevented him from being present at the moment, and the agenda was then considered.

In the absence of Dr. J. Faria Lapa, *Special Reporter*, who was excused, the President asked Mr. J. Santos, his representative, to read in turn the various points of the Summaries formulated by the Special Reporter.

Summary No. 1 :

1. Miscellaneous goods are generally conveyed by through wagons and by pick-up and distributing wagons, or separate pick-up and distributing wagons.

From the point of view of output as well as economy, and in order to improve the service, it is advantageous to adopt an organisation that will enable the user of both stock and labour to be increased, the amount of handling reduced, and the turnround speeded up. These results are obtained when the number of through wagons reaches the maximum and the load per wagon is also the maximum. These maxima depend upon specific characteristics of the operating conditions on each Railway.

Mr. Moulart *(Reporter)* suggested the following amendment :

He proposed the words « or by wagons used for all purposes » to be added to the end of the first paragraph

The second paragraph to be modified as follows : « it is an advantage to adopt an organisation which allows of an increase in the average load carried by each wagon and in a reduction of the labour involved and a consequent acceleration of movement. This result is obtained when the number of through wagons reaches a maximum, due consideration must be given to the minimum load for each wagon, the latter depending upon the operating conditions on each Railway. »

Mr. J. Santos, representing the Special Reporter, signified his agreement.

The following text was agreed :

« 1. Miscellaneous goods are generally conveyed by through wagons and by pick-up and distributing wagons, or separate pick-up and distributing wagons or by wagons used for all purposes.

« From a point of view of output as well as economy, and in order to improve the service, it is advantageous to adopt an organisation which allows of an increase in the average load carried by wagons, and of a reduction in the labour involved and in an acceleration of move-

ment. This result is achieved when the number of through wagons reaches a maximum; due consideration being given to each wagon carrying a minimum load, the latter depending on the operating conditions on each Railway. »

Summary No. 2 :

2. The method to be followed by those Railways, which are in a position to do so, is to send the miscellaneous goods by rail between a certain number of centre-stations, carefully selected, whence they can be distributed or towards which they can be concentrated by means of road and/or railway services. Provision must also be made for a possible increase in the traffic as a result of the improved services offered, and a reduction in the number of claims for delays, losses, theft and damage.

Mr. GUIBERT *(Soc. Nat. des Chemins de fer français)* proposed the following amendment to the last sentence :

« One can assume, as a result of the improvement of the service, a consolidation and even an increase in traffic... »

Mr. MOULART suggested that in the first sentence « ... the Railways which are in a position to do so » should read « ... the Railways, where the density of traffic warrants it... ». Furthermore, Mr. MOULART supported Mr. GUIBERT's proposal.

Mr. LALONI *(Chemins de fer de l'Etat italien)* was of the opinion that the summaries of the special Report were of too general a character and he asked Mr. MOULART to amplify his conclusions in the course of the discussions and in accordance with his own report as he had prepared it for the point 2.

The following text was agreed :

« 2. The method to be followed by those Railways where the density of traffic warrants it, is to send miscellaneous goods by rail between a certain number of centre-stations, carefully selected, whence they can be distributed or towards which they can be concentrated by means of road and/or railway services. One can assume, as a result of the improvement of the service, a consolidation or even an increase in traffic and a reduction in the number of claims for delays, losses, thefts and damages.

Summary No. 3 :

3. When dividing up the railway and road transport as a result of the above mentioned method, the cost of each kind of transport must be taken into account as much as possible when the Railway itself operates the road services, or the actual cost to the Railway when a contractor undertakes them.

This division may prove a stage in the co-ordination of rail and road.

Mr. MOULART emphasising that the special Reporter had made a distinction between the cost price and the price paid of transport effected by a contractor, considered that rationally it is the cost price which should be taken as a base and he proposed to say that « the cost price of each method of transport should be considered. In the general interest, the cost price should be established in accordance with common bases of amortisation, upkeep and operation ».

Mr. GUIBERT in associating himself with Mr. MOULART, was of the opinion that, if the public interest were considered, the price paid should be the main considera-

tion. Particularly in the case of lines which it was not proposed to close for full wagon traffic, the cost price to be compared with the cost price of road transport is a marginal cost price.

In accordance with this, the text should be altered as follows :

« ... Nevertheless, as far as Railway services are concerned, it is legitimate to take into account only the marginal cost price on the lines which it is not proposed to close for Railway traffic. As far as road services are concerned, the extra advantages, especially the delivery to the premises of important traders, must be taken into account. »

This amendment gave rise to an exchange of views in which the following took part :

Messrs Cottier *(Office Fédéral Suisse des Transports)*, J. Santos, Laloni, Moulart, Miles Beevor *(British Transport Commission)* and Pike *(Railway Executive, British Railways)*.

Finally the Meeting agreed to the following text :

« 3. When dividing up miscellaneous traffic between rail and road transport, account should be taken of the extra expense incurred by road transport, the economies which Railways can effectively realise in rail transport and the advantages peculiar to each mode of transport.

« This division may prove a stage in the co-ordination of rail and road. »

Summary No. 4 :

4. The above Summary No. 3 strengthens the principle that road transport firms should be subject to the same obligations as the Railway and to the same principles on which railway rates are based — as far as is compatible with their technique and method of operation.

Mr. Guibert considering that the operating of road services, subsidiary to the Railways, should remain under the control of the Railways, suggested that the original wording of Summary 4, should be deleted and should be replaced by the following :

« Road services should preferably be organised under the control of the Railway and should be subject to the same obligations as those of the public railway service. »

After remarks by Messrs Cottier, Miles Beevor, Laloni, Vanderborght *(Soc. Nat. des Chemins de fer Belges)*, Sarma *(Reporter)*, Moulart, the summary proposed by Mr. Guibert was agreed in the following form :

« 4. The road services organised in place of, or in conjunction with Railway services, should preferably be under the responsibility of the Railway, and should be subject to the same obligations, the Railways maintaining direct contact with the traders. »

Summary No. 5 :

5. Goods should be sent by through wagon, as far as possible from centre to centre, or if this cannot be done by making use of some transhipment centres. Only such stations will have any appreciable amount of traffic to handle.

Mr. Moulart proposed to substitute in the first sentence « ... some transhipment centres » by : « ... a minimum number of transhipment centres » and

also : « ... Only such stations » by « ... Only certain of those stations... ».

Mr. VANDERBORGHT considered that the second part of the Summary could be deleted.

Mr. PIKE stated that the special report does not mention the method of handling and sorting of goods, which, however, are dealt with at length in the reports. The British Railways have had this question in mind for several years and Mr. PIKE considered it should be the subject of a future discussion by the Congress. He suggested the following addition to Summary 5.

« The most expeditious and economic methods of handling and sorting miscellaneous traffic at such centres deserves special study. »

Mr. VANDERBORGHT moreover proposed, in order to take into account the improvements of mechanisation, to describe the idea expressed by Mr. PIKE and to add the following text to Summary 5

« The mechanisation of handling connected with loading and unloading of goods in centre-stations and in transhipping stations is such as to lower considerably the cost price of the transport of goods consignments of less than full wagon loads.

« The lay-out of centre-stations should be such as to reduce to a minimum the movement of loading and unloading equipment and staff from one place to another. »

THE PRESIDENT observed that the proposed text was too detailed. He suggested a wording combining the two propositions, and the following text was agreed to for Summary 5 :

« 5. Goods should be sent by through wagons as far as possible from centre to centre, or, if necessary, through a minimum number of transhipping stations.

« The most expeditious and economic methods of handling and sorting miscellaneous traffic at such centres deserves special study, particularly the methods of mechanised handling. »

It being now late, the PRESIDENT proposed to postpone to to-morrow the study of the remaining summaries and declared the Meeting closed at 12.15 p. m.

Meeting of the 3rd June 1949.

Mr. Rogerio V. RAMALHO *in the Chair.*

— The Meeting opened at 9.40 a. m.

Mr. MILES BEEVOR suggested that the summaries agreed yesterday should be reviewed and some of them re-drafted more accurately.

— Summaries 1, 2 and 3 were finally agreed without further discussion.

Summary No. 4 :

With reference to this Summary, Mr. MILES BEEVOR remarked that in Great Britain Railway services and road transport, which were part of the same transport organisation, worked in close collaboration, and he was of the opinion that in these circumstances it was incorrect to say that « road services should be under Railway management ».

Messrs Moulart, Cottier and Laloni discussed the question of the use of rail and road transport contract which forms the basis of the responsibility *towards the traders*, this being the only question under discussion.

Several modifications of the text were proposed by Messrs Sarma and Vanderborght. The following text comprising the different suggestions was proposed :

« 4. Traffic dealt with by road services, in substitution of, or complementary to railway services, should preferably be operated under the responsibility of the railways, the latter making direct contact with the traders.

« These road services should be subject to the same obligations as those of the public railway services. »

Mr. Miles Beevor agreed with this text, which was definitely adopted.

Summary No. 5 :

— Summary No. 5 adopted at the previous meeting was read and definitely approved.

The President then passed on to the discussion of the summaries which it had not been possible to deal with on the previous day.

Summary No. 6 :

6. Night work can have a favourable effect on the transit time, so provision must be made for it in those stations where it is necessary.

Mr. Vanderborght suggested the words « ... Night work having a favourable effect ... » instead of « ... can have a favourable effect », and Mr. Moulart suggested that the word « reduction » should be deleted. *(This, however, does not appear in the English translation.)*

The following text was agreed :

« 6. As night work has a favourable effect on the transit time, it should be instituted at the stations where the necessity arises. »

Summary No. 7 :

7. The part played by grouping agents and agents is of advantage to the Railway in the sense that the traffic is concentrated thereby and the output of the stock improved.

The rating benefits generally granted to grouping agents should depend on an undertaking by the latter to limit their activities to the sector given them by the railway and to deliver to the railway all the traffic it can deal with.

The fees paid to agents are made good by the advantages obtained by the appreciable services rendered to clients and the possibility of making economies in the staff, either by closing certain stations to parcels traffic, or reducing the number of employees.

Mr. Pike was unable to accept the wording as proposed, because the « grouping system » does not exist in Great Britain, partly because of custom and partly the question of tariff.

He would, however, agree with the substance of the text, provided the following words were added at the beginning :

« In those countries where such a system is in existence... »

The President suggested the following amendment to the beginning of the second paragraph :

« When the rating benefits are granted to grouping agents, they should... »

Mr. GUIBERT considered that, in the suggested wording the first paragraph of the summary did not give the exact meaning — thus the improvement in working of the stock is not evident because wagons loaded by grouping agents can be used for two purposes in conjunction with wagons loaded with miscellaneous goods by the Railways themselves.

The advantages to be expected from the grouping system are principally commercial, because having no statutory obligation they can give the best service to the traders.

Mr. GUIBERT proposed, therefore, the following wording for the beginning of Summary No. 7. :

« The part played by grouping agents and agents is of advantage to the extent that they render services to the traders which the Railway cannot normally provide. »

Mr. LALONI insisted that the technical advantages of concentration by the grouping agents should be stressed. He considered these advantages most important.

Mr. JOFFRE *(Soc. Nat. des Chemins de fer francais)* did not agree that there were any advantages in this because the activity of grouping agents is exercised particulary between large centres, that is to say, where the Railways themselves can effectively carry out the operations.

After a further exchange of views, Mr. GUIBERT proposed a text which would satisfy Mr. LALONI and the following wording, taking into account the remarks of the British delegates, was agreed :

« 7. In the countries where such systems exist the part played by grouping agents and agents is of advantage to the extent that these intermediaries facilitate the concentration of traffic and render to the traders services which the railway is not normally in a position to provide.

« The rating benefits wherever granted to grouping agents should depend on an undertaking by the latter to limit their activities to the sector given them by the railway and to deliver to the railway all the traffic it can deal with.

« The fees paid to agents are made good by the possibility of making economies in the staff, either by closing certain stations to parcels traffic, or reducing the number of employees. »

Summary No. 8 :

8. In organising road services to or from the centre-stations, it is advisable to adopt a solution similar to that introduced in the case of the collection and delivery services.

Mr. PIKE asked for clarification of the meaning of the latter part of this summary.

Mr. SARMA said that he understood this to mean that the road services should be part of the Railway services.

Mr. VANDERBORGHT expressed the opinion that this summary should be deleted.

Mr. COTTIER suggested on the contrary that this question is most important and should be defined in such a way as to include a recommendation to make use

of the services of professional haulage agents for operating station centres, which would be in accordance with the idea of co-ordinating rail and road services.

Mr. Vanderborght insisted that his original suggestion to delete Summary No. 8 should stand and added that it was premature to discuss the delicate problem of co-ordination which merits a special discussion by the Congress.

Mr. Laloni associated himself with this view, as did the President, and the Delegates being in agreement, the first text of Summary No. 8 was deleted.

Summary No. 9 :

9. If there is not much traffic on certain sections, the number of road services can be limited to 3 or 2 a week (thereby increasing the transit times), or other existing methods of transport made use of which can carry out the terminal transport without additional cost (vans on passenger or goods trains, light railway services, buses, etc.).

— This Summary was adopted without discussion and will be the new no. 8 as hereafter :

« 8. If there is not much traffic on certain sections, the number of road services can be limited to 3 or 2 a week (thereby increasing the transit times), or other existing methods of transport made use of which can carry out the terminal transport without additional cost (vans of passenger or goods trains, light railway services, buses, etc.) »

Summary No. 10 :

10. The total amounts charged should as far as possible be the same independently of the method of transport used, whether the goods travel by road or by rail to and from the centre-stations.

Slight modifications in the wording of the text were proposed by Messrs. Guibert and Moulart, and the following text was agreed :

« 9. Where the system of centre-stations is in use the total price charged should be as far as possible independent of the method of transport utilised. »

Summary No. 11 :

11. The usefulness of collection and delivery services can be increased to the extent that it is possible to fit them in with the working of the centre-stations.

Mr. Guibert, having remarked that the proposed wording was not quite clear, Mr. J. Santos said that, in effect, this summary could be stated clearly in accordance with Mr. Moulart's report. The latter was of the opinion that the text should be amplified by a reference to the rates applied to terminal transport. Actually, as stated in certain replies received to the questionnaire, certain Railways base their rates on the weight of the consignment and the distance it is carried by lorry, others base their rates on weight alone, and in the latter case there is the risk of loss of traffic to road transport where short distances are involved.

Mr. Moulart suggested that the wording of summary No. 11 should be re-stated as follows :

« The organisation of the station-centre system will allow, in a number of cases, of economical development of delivery and collection services.

« It is desirable that the rates for these services should take into account the weight of the consignment and the distance it is carried. »

Mr. PIKE hesitated to accept this text because in Great Britain the rates — « door to door » do not take into account the distance of haulage by lorry, and he asked if it were not possible to delete the second sentence.

Messrs. GUIBERT and MOULART insisted on the usefulness of the principle stated, which is, after all only in the nature of a hope.

In view of the last suggestion, Mr. PIKE withdrew his objection and the original text proposed by Mr. MOULART was definitely adopted under the new No. 10 as follows :

« 10. The organisation of the station-centre system will allow, in a number of cases, of economical development of delivery and collection services.

« It is desirable that the rates for these services should take into account the weight of the consignment and the distance it is carried. »

THE PRESIDENT announced that, with the adoption of this final summary, the work confided to the section was complete.

THE PRESIDENT expressed his satisfaction in being relieved of a heavy responsibility and also his regret at terminating the pleasant collaboration with all the delegates who had taken part in the work of the section.

He expressed his best thanks to the delegates and to the members of the Bureau and wished them a good journey home, and hoped that they would retain pleasant memories of their sojourn in Portugal.

Messrs. MILES BEEVOR and VANDERBORGHT thanked the PRESIDENT personally, and on behalf of their colleagues, for the kind remarks which he had made, and they expressed their appreciation in the warmest terms of the way in which he had conducted the discussions.

— The session was closed at 11.55 a.m.

Note. — The full text of the Summaries for Question III is given hereafter, on pages 672 and 673.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

Enlarged Meeting of the Permanent Commission at Lisbon

(1st-4th June 1949.)

Plenary Meeting held on the 4th June, 1949.

PROCEEDINGS.

Mr. F. H. Delory, *President of the Association, in the Chair.*

— The meeting was opened at 10.45 a. m.

The President stated that the only point on the agenda was the examination of the Summaries relating to questions I II and III, as adopted by the Sections.

He requested the *General Secretary*, Mr. Ghilain, to read in turn these Summaries.

No objection was raised during the reading of the French text of the Summaries.

With regard to *point 4* of *the English text* of the Summaries of *Question III*, Mr. Ramalho *(President of Section 3)* suggested to substitute the words « ... should preferably be operated... » by « ...should preferably be *carried*... ».

— *The Meeting approved.*

— *The English text of the Summaries is therefore also adopted, with the above mentioned amendment to Summary 4 of Question III.*

— **The final text of the Summaries of Questions I, II and III is reproduced in the Appendix, pages 668 to 673 of this Bulletin.**

The President, after the approval of the Summaries, declared the Meeting closed and expressed his best thanks to all Delegates and in particular to the President of the Local Organizing Commission, Mr. da Costa Couvreur, who has done his utmost to succeed to achieve the best results.

He also heartily congratulated the Reporters, the Special Reporters and the Secretaries on their valuable contribution to the success of the Meeting.

He underlined finally the important part played by Mr. Ghilain, *General Secretary*, in the particularly heavy tasks, which the organisation of the Meeting placed upon him and said that everyone had appreciated the valuable results obtained.

The President concluded by wishing the Delegates a happy return in their respective countries.

(Loud applause.)

— The Meeting was closed at 11.30 a. m.

APPENDIX.

SUMMARIES

adopted by the Plenary Meeting of the Permanent Commission on the 4th June 1949.

1st SECTION : WAY AND WORKS.

QUESTION I.

a) Mechanisation of the maintenance and renewal of the permanent way.

b) Recent improvements relating to reinforced concrete and prestressed concrete sleepers. Results obtained.

c) Recovery and strengthening of metal bridges that have reached the theoretical limit of safety.

Summaries.

a) *Mechanisation of the maintenance and renewal of permanent way.*

« 1. The use of mechanical plant is not « yet general in all countries but in certain « countries it has already passed the « experimental stage for renewal work « and in some cases even for maintenance.

« 2. The use of mechanical methods « undoubtedly presents economic advant- « ages in carrying out renewal work and « for removing and cleaning ballast. It is « equally advantageous for maintenance, « particularly that of sleepers and fasten- « ings, provided the work is of sufficient « extent to justify the employment of « special gangs.

« 3. In addition to economic advant- « ages, the use of mechanical equipment « also results in appreciable technical « advantages.

« The work is often more uniform, « better and more lasting, compared with « manual work; the time taken for cer- « tain operations is shortened which is of « great importance when the line is only « available for a short period; the work « is less fatiguing for the staff. It is « possible to introduce or develop further « new maintenance methods such as « grinding the rails, building up the ends « of rails and crossings by welding, etc.

« 4. To obtain a good output from both « men and machines on work where « either mechanical plant or a large « number of modern hand tools are used, « it is most necessary to examine in the « fullest detail possible the organisation « of the work and its subdivision into « well defined tasks, each one allocated to « a particular gang.

« 5. The maximum output from mechan- « ical plant for removing and cleaning « ballast and for removing and relaying « track can be obtained when long inter-

« vals between the passing of trains are « available. This practice enables renewal « work to be accelerated, reduces the « delay in carrying out such works on a « given section of line and in particular « reduces the expenditure of all depart- « ments, especially the cost of reduced « speeds.

« 6. In view of the frankly evolutionary « stage of the matter in most countries « it is not possible to formulate any « definite summaries regarding the type « of mechanisation most to be recom- « mended nor the types of machines most « suited to the different operations.

« 7. In general the use of mechanical « plant greatly improves conditions of « work : it constitutes therefore a factor « in social progress which is not to be « neglected.

« Since fewer men are required and to a « large extent heavy manual work avoided, « mechanisation of renewals and mainten- « ance of the permanent way facilitates « the recruiting of staff for permanent « way and contract works, especially in « industrial areas.

« 8. It is desirable in future in the case « of new railway construction or when « modifying existing lines to provide « large cesses to facilitate the use of « mechanical equipment and generating « plant.

« 9. The application of scientific me- « thods of organisation of work with the « use of mechanical plant or hand tools « for renewal and maintenance of the per- « manent way with particular reference to « reducing the difficulty of the work and « increasing the output of the personnel « is to be recommended on account of « the technical, economic and social « advantages which this offers. »

b) *Recent improvements relating to reinforced concrete and pre-stressed concrete sleepers. Results obtained.*

« 1. The use of concrete sleepers is « still limited.

« 2. From experience already gained as « far as non pre-stressed concrete sleepers « are concerned, it can be concluded that « the behaviour of these sleepers on lines « with important traffic is not satisfac- « tory. For this reason certain systems « limit their use to secondary lines with « light traffic or to sidings.

« 3. The systems which utilise non pre- « stressed concrete sleepers in general « prefer the mixed type consisting of « blocks joined by tie-bars.

« 4. Pre-stressed concrete sleepers offer « greater resistance to impact effects than « do ordinary reinforced concrete sleepers. « Having regard to the results obtained « in laboratory tests it can be hoped that « they will give satisfactory results even « on lines with important traffic, and « especially if they are fitted with elastic « fastenings.

« 5. Improvements seem to be neces- « sary in order that reinforced concrete « sleepers may be used on electrified lines « and on lines with track circuits.

« 6. The method of fastening the rail to « the sleeper is very important as far as « the protection of the latter is concerned.

« The types of fastening which have « proved the most satisfactory are :
« — indirect fastening with separate fas- « ening of the rail and the bearing plate, « without any intermediate elastic plate;
« — a completely elastic fastening (elastic « clip and non-rigid packing).

« 7. If the use of reinforced concrete « sleepers is to prove economical compa- « red with that of wood and steel sleepers « their manufacturing costs must be « greatly reduced below the present level.

« 8. It would be of interest to carry out « tests regarding the use of long welded « rails in conjunction with that of rein- « forced concrete sleepers in order to « determine the technical possibilities of « this method and its financial repercus- « sions. »

c) *Recovery and strengthening of metal bridges that have reached the theoretical limit of safety.*

« 1. The renewal or strengthening of a « metal railway bridge is generally neces- « sitated on account of increased rolling « loads and also by increased speeds or « on account of reduced sections due to « corrosion.

« 2. The strength of existing metal « bridges is determined by theoretical « calculations often checked by direct « measurement of the stress on the « bridge in question.

« The permissible stresses for existing « structures are generally appreciably « higher than those allowed for the con- « struction of new work.

« 3. Each case of a bridge which has « reached its limit of safety should be « examined separately in its own proper « place in order to determine the best « technical and economical solution and « the relative merits of strengthening as « opposed to renewal should be examined.

« 4. The re-use of complete bridges « from other lines when circumstances « allow can be an interesting and economic « procedure.

« 5. Strengthening by welding is an « economic and practical procedure which « is being adopted to an increasing ex- « tent : it requires to be carefully carried « out.

« The use of this method for old iron « bridges requires a procedure adapted « to the nature of the metal.

« 6. The strengthening of sections by « rivetting is still the method most gene- « rally used, but it cannot be recommend- « ed when the addition of supplementary « parts involves removing the rivets from « important fastenings.

« 7. The strengthening of bridges by « the addition of new framework, con- « struction of new supports, etc., without « modifying the old structure is recom- « mended.

« 8. Strengthening certain bridges by « reinforced concrete has given good « results. In recent applications of this « method simple exterior shapes have « been preferred and effective bonding « between steel and reinforced concrete « has been sought. »

2nd SECTION : LOCOMOTIVES AND ROLLING STOCK.

QUESTION II.

Electric locomotives for fast trains (75 m.p.h. and over).

Discussion of adopted and projected types.

1. **Arrangement of the axles.**
2. **Type of axle drive :**
   a) **motor suspended from the nose;**
   b) **flexible transmission.**
3. **Electric motor characteristics.**
4. **Braking.**

Summaries.

« 1. Concrete achievements show that « the construction of locomotives for « speeds running up to 160-180 km./h. « (100-112 m.p.h.) is possible. The prin- « cipal and most severe technical restric- « tions to the adoption, for normal « services, of speeds of this kind arise « from the layout of the lines, super- « elevation, and signalling requirements, « in conjunction with the minimum num- « ber of stops.

« 2. The design of the mechanical « portion of locomotives, where the ar- « rangement of axles is concerned, is « influenced by the prevailing conditions « on the different railway systems; which « explains certain important differences « which are noticed between the U. S. A. « and European methods of construction. « American construction tended towards « an arrangement of axles with a guiding « bogie and articulated frames. The « present tendency, however, in all coun- « tries tends towards locomotives fitted « with motor bogies on 2 or 3 axles and, « in general, with total adhesive weight.

« 3. The numerous systems of axle- « drive in use appear to be still in a state « of evolution, although constructors « appear to prefer solutions allowing a « certain liberty of movement between « the ensemble of the toothed wheels in « mesh and the axle or else the motor- « shaft.

« The nose suspended motor is still in « use and it is even being adopted in « certain countries for new stock now « being designed.

« 4. There is no special features as « regards the traction motors used on « fast locomotives.

« 5. The problem of braking still exists « in spite of progress made for a better « use of adhesion and friction and ap- « pears as the most difficult to solve in « view of the great power to be dissi- « pated. »

3rd SECTION : WORKING.

QUESTION III.

Transport of miscellaneous goods.

Concentration in a certain number of selected centres (stations) of miscellaneous traffic, transport by rail between centre-stations, by road or rail between the originating point and the nearest centre-station, and also to the last centre-station near the destination.

Interest of the scheme for the conveyance of goods traffic.

Organisation of the station-centres and of the collection and delivery services.

Financial results of the scheme.

Summaries.

« 1. Miscellaneous goods are generally « conveyed by through wagons and by « pick-up and distributing wagons, or « separate pick-up and distributing wa- « gons or by wagons used for all purposes.

« From a point of view of output as « well as economy, and in order to im- « prove the service, it is advantageous to « adopt an organisation which allows of « an increase in the average load carried « by wagons, and of a reduction in the « labour involved and in an acceleration « of movement. This result is achieved « when the number of through wagons « reaches a maximum; due consideration « being given to each wagon carrying a « minimum load, the latter depending on « the operating conditions on each Rail- « way.

« 2. The method to be followed by « those Railways where the density of « traffic warrants it, is to send miscella- « neous goods by rail between a certain « number of centre-stations, carefully « selected, whence they can be distributed « or towards which they can be concen- « trated by means of road and/or railway « services. One can assume, as a result « of the improvement of the service, a « consolidation or even an increase in « traffic and a reduction in the number « of claims for delays, losses, thefts and « damages.

« 3. When dividing up miscellaneous « traffic between rail and road transport, « account should be taken of the extra « expense incurred by road transport, the « economies which Railways can effec- « tively realise in rail transport and the « advantages peculiar to each mode of « transport.

« This division may prove a stage in « the co-ordination of rail and road.

« 4. Traffic dealt with by road services, « in substitution of, or complementary to « railway services, should preferably be « carried under the responsibility of the « railways, the latter making direct con- « tact with the traders.

« These road services should be subject « to the same obligations as those of the « public railway services.

« 5. Goods should be sent by through « wagons as far as possible from centre « to centre, or, if necessary, through a « minimum number of transhipping sta- « tions.

« The most expeditious and economic « methods of handling and sorting miscel- « laneous traffic at such centres deserves « special study, particularly the methods « of mechanised handling.

« 6. As night work has a favourable « effect on the transit time, it should be « instituted at the stations where the « necessity arises.

« 7. In the countries where such sys- « tems exist the part played by grouping « agents and agents is of advantage to the « extent that these intermediaries facili- « tate the concentration of traffic and « render to the traders services which the « railway is not normally in a position « to provide.

« The rating benefits wherever granted « to grouping agents should depend on an « undertaking by the latter to limit their « activities to the sector given them by « the railway and to deliver to the railway « all the traffic it can deal with.

« The fees paid to agents are made « good by the possibility of making « economies in the staff, either by closing « certain stations to parcels traffic, or « reducing the number of employees.

« 8. If there is not much traffic on « certain sections, the number of road « services can be limited to 3 or 2 a week « (thereby increasing the transit times), « or other existing methods of transport « made use of which can carry out the « terminal transport without additional « cost (vans of passenger or goods trains, « light railway services, buses, etc.).

« 9. Where the system of centre-sta- « tions is in use the total price charged « should be as far as possible independent « of the method of transport utilised.

« 10. The organisation of the station- « centre system will allow, in a number « of cases, of economical development of « delivery and collection services.

« It is desirable that the rates for these « services should take into account the « weight of the consignment and the « distance it is carried. »

[385. (06 .111]

OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association.

Meetings held by the Permanent Commission at Lisbon (1st to 4th June, 1949.)

In addition to its annual Meeting, the Permanent Commission held at Lisbon on the 1st, 2nd, 3rd & 4th June 1949, several technical sessions which were attended not only by most of its members but also by a number of their Assistants, i.e. Engineers and High Officials of the large Railway Systems.

The agenda of the technical sessions included the examination of three questions of general and current interest to railways :

I. « *a*) Mechanisation of the maintenance and renewal of the permanent way;

« *b*) Recent improvements relating to reinforced concrete and prestressed concrete sleepers. Results obtained.

« *c*) Recovery and strengthening of metal bridges that have reached the theoretical limit of safety.

II. « Electric locomotives for fast trains (75 m.p.h. and over).

« Discussion of adopted and projected types.

« 1. Arrangement of the axles;

« 2. Type of axle drive :

« *a*) motor suspended from the nose;

« *b*) flexible transmission.

« 3. Electric motor characteristics.

« 4. Braking. »

III. « Transport of miscellaneous goods.

« Concentration in a certain number of selected centres (stations) of miscellaneous traffic, transport by rail between centre-stations, by road or rail between the originating point and the nearest centre-station, and also to the last centre-station near the destination.

« Interest of the scheme for the conveyance of goods traffic.

« Organisation of the station-centres and of the collection and delivery services.

« Financial results of the scheme. »

The study of these questions had been decided at the session held by the Permanent Commission on 14th February 1948.

The list appearing in the Appendix 2, pages 684 to 687 of the present *Bulletin*, gives the names of members of the Permanent Commission and their assistants who were delegates at the technical meetings.

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A first meeting of the Permanent Commission was held on 1st June last at the *INSTITUTO SUPERIOR TECNICO* at Lisbon.

The session, which opened at 9.30 a.m., was presided by Mr. F. H. Delory, Director General of the Belgian National Railways and President of the Association.

After having extended a welcome to the numerous personalities present, the President informed the Meeting of the changes that had occurred in the membership of the Permanent Commission since the meeting held on December 4th last.

The Meeting proceeded to nominate as members of the Commission the following personalities :

Mr. E. G. J. Üpmark, General Manager of the Swedish State Railways in the place of Mr. G. O. W. P. Dahlbeck, retired;

Mr. F. C. Badhwar, Member, Railway Board, Ministry of Railways (Government of India) in the place of Mr. R. de K. Maynard, who does not belong anymore to the Administration of India;

H. E. Khadr Gabr Bey, Directeur général adjoint de l'Administration des Chemins de fer, Télégraphes et Téléphones de l'Etat égyptien, in the place of H. E. El Sayed Gawdat Bey;

Mr. W. H. W. Maass, Advisory Engineer to the High Commissioner for the Union of South Africa (London), in the place of Mr. H. D. Ward Smith;

Mr. Mayer Grümberg, Engineer, General Manager of the Rumanian Railways.

The President further informed the Meeting that the Executive Committee had proposed, in virtue of § 5 of Art. 6 of the Rules and Regulations, the creation of a new mandate in favour of Norway, of whom the holder would be Mr. Egil Sundt, General Manager of the Norvegian State Railways.

This nomination is approved with the proviso of its final ratification by the next Congress.

On another hand, the Assembly unanimously approved the President's proposal to maintain as an effective member of the Permanent Commission, until the Rome congress, Mr. R. da Costa Couvreur, who has reached the retiring age, on account of the eminent services he rendered to the Association.

— The following Appendix I *shows the present composition of the Permanent Commission.*

The Assembly then formed the Bureau of the technical sessions to be held on June 2nd and 3rd as follows :

SECTION I. — **Way and Works.**

President :

Mr. R. Lévi.

Vice-Presidents :

Mr. de Campos Henriques; Mr. M. C. Lucchini.

Principal Secretary :

Mr. J. Dubus.

Secretaries :

Mr. J. Brechot; Mr. M. E. Constant and Mr. J. Perestrelo Guimarais.

SECTION II.

Locomotives and Rolling stock.

President :

Sir Cyril HURCOMB.

Vice-Presidents : Mr. F. Q. DEN HOLLANDER; Mr. A. DA Silveira BUAL.

Principal Secretary :

Mr. UYTBORCK.

Secretaries : Mr. H. BONNEFON; Mr. Eyre A. W. TURBETT; Mr. J. Lopes MONTOYA.

SECTION III. — **Working.**

President :

Mr. Rogério RAMALHO.

Vice-Presidents : Mr. G. DI RAIMONDO; Mr. M. DIAS TRIGO.

Principal Secretary :

Mr. E. VOORDECKER.

Secretaries : Mr. J. DELACOUR; Mr. J. H. GLENDINNING; Mr. C. SANTOS.

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Mr. GHILAIN, *General Secretary*, next informed the Assembly of the results of the consultation held for the purpose of drawing up the agenda for the *Rome Congress* (1950).

The list of questions to appear on the programme of work of the 15th Session was discussed and finally approved. This list is published in APPENDIX 3, pages 688 to 689 of the present *Bulletin.*

The *General Secretary* gave a review of the proposed allotment of reports among adherent countries and reported that the Executive Committee would forthwith proceed to nominate Reporters who still had to be appointed to present papers on each of the proposed questions.

The Local Organizing Committee of the Rome Session is now being formed and will include high Government and Italian Railway officials.

It will be presided by Mr. DI RAIMONDO, Director General of the Italian State Railways.

Mr. DI RAIMONDO having prpposed the first fortnight in October 1950 as the date of the Congress, the PRESIDENT considers that this date might be suitable but that one should, as far as possible, avoid its coinciding with the date of other important international meetings.

***

THE PRESIDENT informs the Assembly of a proposal by the Executive Committee to create a new review dealing with questions concerning electric traction.

It is decided to set up a sub-committee entrusted with studying the question and whose conclusions will be presented at a future meeting of the Permanent Commission to be held on June 4th (see the report of this session, page 677 of this *Bulletin*).

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Mr. GHILAIN, *General Secretary*, next submits to the Assembly a scheme for reorganizing the preparation of Congresses, with a view to avoiding imperfections caused by the usual method of questionnaires to be submitted to member Administrations, and to ensure complete

uniformity of views as regards these questionnaires. Measures are suggested with a view to coordination of the opinions of the reporters for one and the same question in framing the wording of the summaries to be submitted to the Congressional Sections.

— These proposals are unanimously adopted.

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The account of receipts and expenses for the financial year 1948 is approved by the Assembly; the latter is also informed as to cash in hand on May 1st 1949.

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An account is given of changes in adhesions that have occurred since the meeting of December 4th 1948.

Two new adherents have been recorded : the *Iranian Railways* (2 500 km. [1 534 miles]) and the *Pakistan Government*.

The International Railway Congress Association now includes 34 Governments, 8 Organisations and 109 Administrations with a network of about 450 000 kilometres (280 000 miles).

***

The discussion of certain points concerning the Association's activity since the last session ends the meeting.

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MEETING OF THE PERMANENT COMMISSION ON JUNE 4th 1949.

The session is opened at 9.40 a. m. under the presidency of Mr. F. H. Delory, *President of the Association*.

The President informs the audience of the object of this meeting, which is to hear the report of the sub-committee formed to report on the creation of a new review annexed to the *Bulletin* and dealing with electric traction, and to decide as regards the conclusions of this sub-committee.

The President calls upon Mr. Goursat, *Vice-President of the Association*, who presided the meetings of the sub-committee.

Mr. Goursat gives a summary of the debates held by this sub-committee, recalling the various points examined : advisability of creating the review — periodicity — eventual inclusion of Diesel-traction — financing of it.

He reports that the members of the sub-committee showed their agreement as to the creation of the new review whose field of action should be fairly wide and comprise motive power, fixed installations (substations, catenaries), economic and financial results of electric traction compared to steam traction and even research concerning Diesel traction with electrical transmission.

To commence, this review would only appear every second month; but when sufficient material is available a monthly edition is proposed.

Pointing out that the Rules and Regulations of the Association contain an obligation upon the latter to distribute any new publications free of charge to members, Mr. Goursat explains the various means of financing studied by the sub-committee. The one adopted would consist of increasing slightly the variable part of subscriptions and the obtaining from members of an undertaking to sub-

scribe for a total of 300 subscriptions to the new review in French and 160 subscriptions to the English edition.

Mr. GOURSAT states that, although the Permanent Commission is entitled to make decisions in the matter, it would be advisable to ask member-Railway Administrations for their agreement as to the creation of the new review, and as to whether the Association can ask them to undertake to subscribe for a certain number of copies.

— No objection having been raised as to this procedure, the PRESIDENT states that the Permanent Commission expresses its approval of the resolutions set forth.

— The meeting rises at 10 a. m.

The General Secretary, *The President*,
(s) P. GHILAIN. (s) F. H. DELORY.

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The technical sessions were also held in the modern premises of the « *Instituto Superior Tecnico* » at Lisbon, kindly placed at the disposal of the Association by the Portuguese Authorities.

The opening session took place on June 1st at 3.30 p. m. It was graced by the presence of the President of the Portuguese Republic, MARCHAL CARMONA, and H. E. the Minister of Communications, Colonel GOMES DE ARAUJO.

After having declared the Lisbon meeting opened, Mr. DELORY, *President of the Association*, expressed his gratitude to the Head of the Portuguese State and to H. E. the Minister of Communications who, by their presence, wished to show the interest they took in progress made by railways and in the work of the Association. He paid a tribute to the work accomplished by the Local Organizing Committee, omen of the undoubted success of the Lisbon Meeting.

Mr. l'Ing. Raul. da Costa COUVREUR then extended a hearty welcome to all the Delegates and stressed the importance of the labours of the Meeting, for which he foresaw the greatest success.

H. E. the *Minister of Communications* reiterated the words spoken by Mr. da Costa COUVREUR and thanked the leading personalities of the Association, in the name of the Portuguese Government, for the honour which feld to his country of entertaining these international sessions, so characteristic of the spirit of collaboration among Railways. He also stressed the importance of railways in economic organisation and ended by expressing the wish that the Lisbon meeting would efficiently contribute to their progress.

The inaugural session was followed by a visit to the Lisbon Town Hall. The delegates went there in motor coaches and a reception was held in the Pink Saloon Araujo by the Chairman of the Municipality, Colonel SALVAÇAO BARRETO, and other high Municipal Authorities. Mr. da Costa COUVREUR presented the Congressionists in a speech and congratulated the Chairman SALVAÇAO BARRETO in their names. The Chairman gave warm thanks and expressed his pleasure at the visit of so many high personalities of the railway world.

The participants were able to admire the wonderful decorations of the saloons in this beautiful City edifice.

The Delegates were then taken in motor coaches to the « Cold Hothouses » (Estufa Fria) where they were able to admire, in a wonderful setting, marvellous specimens of tropical vegetation.

Refreshments were offered to them, and port was served in their honour.

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The technical sessions commenced on June 2nd at 9.30 a. m.

The respective Sections heard the special reports presented on the three questions on the agenda, and interesting discussions took place, in which representatives of the principal Railway Systems shared.

The next day, June 3rd, the work was continued and summaries were discussed and proposed to the Permanent Commission for examination at the Plenary Meeting on June 4th.

This Meeting was held at 10.45 a. m., and all the members of the Permanent Commission attended with their assistants.

Under the Presidency of Mr. Delory, the Assembly examined and discussed the proposals and summaries presented by the Bureau of each of the three sections, and final wording was unanimously approved.

These summaries are reproduced on pages 668 to 673 of the present *Bulletin*.

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On June 2nd 1949, a banquet was offered in the evening by the Permanent Commission to the Portuguese Authorities and Members of the Commission and was presided by Mr. the President Delory. Toasts were given to the respective Heads of State.

The afternoon of June 2nd was devoted to a visit to the Barreiro Workshops of the Portuguese Railway Company, where the Delegates, under the guidance of officials of the Company, were able to admire an interesting exhibit of locomotives, and rolling stock as well as the up-to-date installations of the repair-shops.

On Friday adternoon, June 3rd, the Delegates had been invited to a technical visit of Lisbon and were able to view the numerous works, remarkable public edifices and the beautiful avenues of the new neighbourhoods which make Lisbon a modern city that compares well with certain large capitals.

In the evening the National Theatre of San Carlos gave, in honour of the Permanent Commission of the Association, a magnificent concert performed by the National Symphony Orchestra, conducted by maestro Pedro de Freitas Branco, and this artistic manifestation enabled those present to understand the fine traditions of Portuguese culture.

In the afternoon of Saturday June 4th the Administration of the Port of Lisbon had invited the delegates to visit by boat the installations of the great port on the Tagus, and they thus had an occasion to admire the beauties of this great port equipped with the most modern plant.

The same evening, the Portuguese Government invited all the Delegates to participate in the official banquet given at the Palace Hotel at Estoril. The banquet was presided by H. E. the Minister of Communications, Colonel Gomes de Araujo, assisted by Mr. R. da Costa

COUVREUR, Chairman of the Higher Council of Public Works at the Portuguese Ministry of Communications and Mr. DELORY, President of the Association.

A speech stressing the advantages of international collaboration in railway technical matters was made by the MINISTER OF COMMUNICATIONS and a reply was made by Mr. DELORY who, speaking on behalf of all the delegates, again expressed the sentiments of great sympathy with Portugal.

On Tuesday 7th and Wednesday 8th June, an excursion to Porto, kindly offered by the Portuguese Railway Company, was organized in honour of the Delegates and their wives.

The departure took place via the *Western line*, which runs along the Atlantic seabord for nearly its whole length, and after Torres Vedras, an important winegrowing centre, and Caldas da Rainha, a seaside resort formerly frequented by the Court, the station serving Alcobaça was reached. Motor coaches carried the delegates to *Alcobaça* to see the wonderful Monastery of *Santa Maria de Vitoria*, built to commemorate the capture of Santarem from the Moors by the first King of Portugal, and of which the church is a gem of Gothic art. Lunch was served to the delegates in the refectory of the monastery. Continuing their way by road, and after crossing a celebrated battlefield, the Delegates arrived at *Batalha*, where they inspected the monastery, cloisters and outbuildings, perfect specimens of the Portuguese « manuelino » style. After another 6 miles by road, the caravan reached *Leiria*, a small pastoral town surmounted by the ruins of a celebrated historical castle, and from thence again reached the station at Leiria. Through a constantly varied and picturesque countryside, the excursion followed the *Northern line* and passed *Coïmbra*, whose University, perched on a hill, is one of the oldest in the world. At Pampilhosa the itinerary continued over the *Beira Alta line* as far as the spa of Luso, where the passengers alighted to admire the famous Buçaco cork oaktree forest. Thence, the motor coaches took the delegates towards Luso and then *Curia*, where the first day of this excursion ended.

The next day the guests departed by train from *Curia*, running along the coast, passing *Aveiro* and *Espinho* and a host of small seaside places, and reached *Porto* of worldwide fame and which offers an impressive vista. Famous structural works there were admired by the technicians, including the « D. Luiz » bridge built by a Belgian firm and the « D. Maria Pia » bridge by the great French constructor EIFFEL. Luch was served at Foz do Douro and after another tour round the town passengers entrained at S. Beneto for the return journey.

This pleasant excursion was an agreeable diversion after several days hard work and will leave a lasting impression in the minds of the numerous guests who took part in it.

List of Members of the Permanent Commission

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(1st June 1949).

President :

F. H. **Delory** (1), directeur général de la Société Nationale des Chemins de fer belges ; 19, rue du Beau-Site, Bruxelles.

Vice-Presidents :

Goursat (2), directeur attaché à la Présidence du Conseil d'Administration de la Société Nationale des Chemins de fer français ; 88, rue Saint-Lazare, Paris (IXe) ;

P. **Ghilain** (3), directeur du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges ; 19, rue du Beau-Site, Bruxelles.

Members of the Executive Committee :

Dorges (1), inspecteur général des Ponts et Chaussées, secrétaire général aux Travaux publics, directeur général des Chemins de fer et des Transports au Ministère des Travaux publics et des Transports ; 244, boulevard Saint-Germain, Paris ;

Sir Cyril **Hurcomb** (2), Chairman of the British Transport Commission ; 55, Broadway, London, S. W. 1 ;

Sir Gilmour **Jenkins** (3), Secretary to Minister of Transport (Great Britain) ; Berkeley Square House, Berkeley Square, London, W. 1.

Ex-presidents of session, members ex-officio :

Baron Edouard **de Rothschild**, président du Conseil d'administration de la Compagnie du Chemin de fer du Nord français ; 27, avenue Bosquet, Paris ;

S. E. Ibrahim Fahmy **Kerim** Pacha ; Le Caire.

Dr W. **Meile**, président de la Direction générale des Chemins de fer fédéraux suisses ; Berne.

Members :

S. E. Ibrahim Dossuky **Abaza** Pacha (2), Ministre des Communications d'Egypte ; Le Caire ;

E. **Alfonso** (2), président du Conseil d'administration du Réseau National des Chemins de fer espagnols ; Madrid ;

Armand (1), directeur général adjoint de la Société Nationale des Chemins de fer français ; 88, rue St-Lazare, Paris (IXe) ;

F. Ch. **Badhwar** (1), Member, Railway Board, Ministry of Railways, Government of India ; New Delhi ;

S. E. Abdel Megid **Badr** Pacha (1), directeur général des Chemins de fer de l'Etat égyptien ; Le Caire ;

V. M. **Barrington-Ward** (3), member of the Railway Executive (British Railways) ; 222, Marylebone Road, London, N. W. 1 ;

M. **Beevor** (2), Chief secretary and legal adviser to the British Transport Commission ; 55, Broadway, London, S. W. 1 ;

Besnard (3), chef de service adjoint au directeur général des Chemins de fer et des Transports, Ministère des Travaux publics et des Transports ; 244, boulevard Saint-Germain, Paris ;

David **Blee** (1), member of the Railway Executive (British Railways) ; 222, Marylebone Road, London, N. W. 1 ;

J. **Bouciqué** (1), directeur du Service de la Voie de la Société Nationale des Chemins de fer belges ; 17, rue de Louvain, Bruxelles ;

Boutet (3), inspecteur général des Ponts et Chaussées, vice-président du Conseil d'administration de la Société Nationale des Chemins de fer français et du Conseil Général des Ponts et Chaussées ; 88, rue Saint-Lazare, Paris (IXe) ;

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(1) Retires at the 15th session.
(2) Retires at the 16th session.
(3) Retires at the 17th session.

O. V. **Bulleid** (1), Chief mechanical engineer, Railway Executive (British Railways-Southern Region); Waterloo Station, London, S. E. 1;

R. **Claudon** (1), inspecteur général des Ponts et Chaussées, membre du Conseil d'administration de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IXe);

M. W. **Clement** (2), chairman of the Board, Pennsylvania Railroad Company; Broad Street Station Building, 1617, Pennsylvania Boulevard, Philadelphia, 4, Pa.;

Dr R. **Cottier** (2), directeur de l'Office fédéral des transports de la Confédération suisse; Berne;

R. **da Costa Couvreur** (2), président du Conseil supérieur des Travaux publics au Ministère des Travaux publics et des Communications du Portugal; Rua de S. Mamede (ao Caldas), 63, Lisbonne;

Dargeou (1), directeur du Service central du Mouvement de la Société Nationale des Chemins de fer français; 8, rue de Londres, Paris (IXe);

J. **de Aguinaga** (3), directeur général adjoint du Réseau National des Chemins de fer espagnols; Madrid;

Ing. V. **Dechitch** (3), Ministre adjoint des Communications de la République fédérative populaire yougoslave; Belgrade;

F. H. **Delory** (already named);

F. Q. **den Hollander** (2), président des Chemins de fer néerlandais, S. A.; Utrecht;

M. **Devos** (2), directeur général de la Société Nationale belge des Chemins de fer vicinaux; 14, rue de la Science, Bruxelles;

Ing. G. **di Raimondo** (2), directeur général des Chemins de fer de l'Etat Italien; Rome;

Dorges (already named);

W. T. **Farici** (1), president, Association of American Railroads; Transportation Building, Washington 6. D. C.;

S. E. Khadr **Gabr** Bey (1), directeur général adjoint de l'Administration des Chemins de fer, Télégraphes et Téléphones de l'Etat égyptien; Le Caire;

P. **Ghilain** (already named);

Goursat (already named);

Ing. Mayer **Grümberg** (3), directeur général des Chemins de fer roumains; Bucarest;

Ranald J. **Harvey** (1), consulting engineer to the Government of New Zealand; 34, Victoria Street, Westminster, London, S. W. 1;

Sir Cyril **Hurcomb** (already named);

Sir Gilmour **Jenkins** (already named);

Ing. Ch. **Kalitzov** (3), chef de la Section du mouvement des Chemins de fer et des Ports de l'Etat bulgare; Sofia;

A. **Kriz** (1), ingénieur, conseiller supérieur de Section au Ministère des Communications de la République tchécoslovaque; Prague;

Dr N. **Laloni** (2), chef du Service Commercial et du Trafic des Chemins de fer de l'Etat italien; Rome;

Lemaire (3), directeur général de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IXe);

R. **Lévi** (3), directeur, chef du Service technique des Installations fixes de la Société Nationale des Chemins de fer français; 42, rue de Châteaudun, Paris;

C. **Lucchini** (3), directeur général des Chemins de fer fédéraux suisses; Berne;

Ing. R. **Luna** (3), directeur général des Chemins de fer de l'Etat argentin; Buenos-Aires;

W. H. W. **Maass** (1), advisory engineer to the High Commissioner for the Union of South Africa; South Africa House, Trafalgar Square, London W. C. 2;

M. **Malderez** (3), secrétaire général du Ministère des Communications de Belgique; 17A, rue de la Loi, Bruxelles;

A. **Marguerat** (2), directeur des Compagnies de Chemins de fer de Viège à Zermatt, Furka-Oberalp, Gornergrat et Schöllenen; Lausanne;

Ing. F. **Marin** (1), vice-directeur général des Chemins de fer de l'Etat italien; Rome;

Ing. P. P. **Martin** (2), inspecteur général de l'Exploitation commerciale, sous-directeur des Chemins de fer de l'Etat argentin; Buenos-Aires;

(1) Retires at the 15th session.
(2) Retires at the 16th session.
(3) Retires at the 17th session.

Dr W. **Meile** (already named);

Ing. E. **Mellini** (2), inspecteur général supérieur, Ministère des Transports; Rome;

Sir Eustace **Missenden** (2), Chairman of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

Sir Alan **Mount** (3), Chief inspecting officer of Railways, Ministry of Transport; Berkeley Square House, Berkeley Square, London W. 1;

P. **Nolet de Brauwere** (1), Secrétaire Général de la Société Nationale des Chemins de fer belges ; 17, rue de Louvain, Bruxelles ;

J. H. **Nuelle** (1), president, Delaware & Hudson Railroad Corporation; 32, Nassau Street, New York City;

G. **Olivier** (2), directeur général adjoint de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

G. **Pader** (2), secrétaire général honoraire de l'Union internationale des chemins de fer, conseiller technique attaché à la Présidence du Comité de gérance de l'U. I. C.; 10, rue de Prony; Paris;

Dr W. **Rauscher** (1), conseiller ministériel, directeur général adjoint et directeur du Service Commercial des Chemins de fer fédéraux autrichiens; Elisabethstrasse, 9, Vienne;

J. M. **Rivero de Aguilar** (1), directeur général du Réseau National des Chemins de fer espagnols; Madrid;

F. **Steiner** (3), Vice-directeur de l'Office fédéral des transports; Berne;

E. **Sundt** (3), directeur général des Chemins de fer de l'Etat norvégien; Oslo;

E. D. **Terkelsen** (1), directeur général des Chemins de fer de l'Etat danois; 40, Sölvgade, Copenhague, K;

J. C. L. **Train** (3), member of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

E. G. J. **Upmark** (3), directeur général des Chemins de fer de l'Etat suédois; Stockholm;

J. **Vanderborght** (2), directeur du Service de l'Exploitation de la Société Nationale des Chemins de fer belges ; 17, rue de Louvain, Bruxelles ;

Th. M. B. **van Marle** (1), inspecteur-generaal van het Verkeer, Rijksverkeersinspectie; La Haye;

L. **Varga** (2), président de la Direction des Chemins de fer de l'Etat hongrois; Budapest;

F. Perez **Villamil** (3), sous-directeur général du Réseau National des Chemins de fer espagnols; Madrid;

Wagner (2), ingénieur en chef au Ministère des Communications de Pologne; Varsovie;

S. E. Dr Sayed Bey Abdel **Wahid** (1), directeur général-adjoint des Chemins de fer de l'Etat égyptien ; Le Caire ;

Dr C. C. **Wang** (3), representative of Chinese Ministry of Communications; 21, Tothill Street, Westminster, London, S. W. 1;

R. B. **White** (2), president, Baltimore & Ohio Railroad Company; Baltimore, Md.;

G. **Willaert** (3), conseiller à la Direction Générale de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Honorary member : U. **Lamalle**, directeur général honoraire de la Société Nationale des Chemins de fer belges, professeur de cours de chemins de fer à l'Université de Louvain; 175, avenue Winston Churchill, Uccle-Bruxelles.

SECRETARY'S OFFICE : 19, rue du Beau Site, Brussels.

General Secretary : P. **Ghilain** (already named).

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(1) Retires at the 15th session.
(2) Retires at the 16th session.
(3) Retires at the 17th session.

LIST OF PARTICIPANTS

TO THE LISBON MEETING.

* Members of the Permanent Commission.

** Assistants to Members of the Permanent Commission.

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* **Armand,** Directeur général adjoint de la Société Nationale des Chemins de fer français. (*Excused.*)

** F. **Nouvion,** Ingénieur principal à la Société Nationale des Chemins de fer français.

* F. Ch. **Badhwar,** Member, Railway Board, Ministry of Railways, Government of India.

* M. **Beevor,** Chief secretary and legal adviser to the British Transport Commission.

* David **Blee,** Member of the Railway Executive (British Railways). (*Excused.*)

** J. R. **Pike,** Chief Officer (Goods), Railway Executive (British Railways).

* **J. Bouciqué,** Directeur du Service de la Voie de la Société Nationale des Chemins de fer belges.

** J. **Van Rijn,** Ingénieur en chef au Service de la Voie de la Société Nationale des Chemins de fer belges.

* **Boutet,** Inspecteur général des Ponts et Chaussées, Vice-Président du Conseil d'Administration de la Société Nationale des Chemins de fer français et du Conseil Général des Ponts et Chaussées.

* O. V. **Bulleid,** Chief mechanical engineer, Railway Executive (British Railways-Southern Region). (*Excused.*)

** E. S. **Cox,** Executive Officer (Design), Railway Executive (British Railways).

* Dr. R. **Cottier,** Directeur de l'Office fédéral des transports de la Confédération suisse.

* R. **da Costa Couvreur,** Président du Conseil supérieur des Travaux publics au Ministère des Travaux publics et des Communications du Portugal.

** F. de Mello **Gavicho,** Chef du Service de Conservation à la Compagnie des Chemins de fer portugais.

** A. Morais **Sarmento,** Inspecteur supérieur de l'Electrotechnique du Conseil supérieur des Travaux publics.

** C. Manitto **Torres,** Ingénieur de 1re classe à la Direction générale des Chemins de fer au Ministère des Communications portugais.

* **Dargeou,** Directeur du Service central du Mouvement de la Société Nationale des Chemins de fer français. (*Excused.*)

** R. **Guibert,** Ingénieur en chef à la Société Nationale des Chemins de fer français.

** G. **Joffre,** Ingénieur principal au Service central du Mouvement de la Société Nationale des Chemins de fer français.

* **J. de Aguinaga,** Directeur général adjoint du Réseau National des Chemins de fer espagnols.

** A. **Crespo,** Ingénieur en chef adjoint du Département des Etudes du Réseau National des Chemins de fer espagnols.

** M. **Maldonado,** Ingénieur au Réseau National des Chemins de fer espagnols.

* F. H. **Delory,** Directeur général de la Société Nationale des Chemins de fer belges, Président de l'Association Internationale du Congrès des Chemins de fer.

* F. Q. **den Hollander,** Président des Chemins de fer néerlandais.

** J. **Cuperus,** Chef du Service de la Voie et des Travaux des Chemins de fer néerlandais.

* Ing. G. **di Raimondo,** Directeur général des Chemins de fer de l'Etat italien.

** G. **Lasz,** Chef du Service du Personnel et des Affaires Générales des Chemins de fer de l'Etat italien.

* E. **Dorges,** Inspecteur général des Ponts et Chaussées, Secrétaire général aux Travaux publics, Directeur général des Chemins de fer et des Transports au Ministère des Travaux publics et des Transports (France).

** P. **Julien,** Ingénieur en chef des Transports au Ministère des Travaux publics et des Transports (France).

* S. E. Khadr **Gabr** Bey, Directeur général adjoint de l'Administration des Chemins de fer, Télégraphes et Téléphones de l'Etat égyptien.

* P. **Ghilain,** Directeur du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges, Vice-Président et Secrétaire géné-

ral de l'Association Internationale du Congrès des Chemins de fer.

** O. **Ghins**, Ingénieur en chef du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges.

Goursat, Directeur attaché à la Présidence du Conseil d'Administration de la Société Nationale des Chemins de fer français.

Ranald J. **Harvey**, Consulting engineer to the Government of New Zealand (Railways).

Sir Cyril **Hurcomb**, G. C. B., K. B. E., Chairman of the British Transport Commission.

Sir Gilmour **Jenkins**, Secretary to Minister of Transport (Great Britain). (*Excused.*)

** C. A. **Birtchnell**, Deputy Secretary, Ministry of Transport (Great Britain).

Dr. N. **Laloni**, Directeur du Service Commercial et du Trafic des Chemins de fer de l'Etat italien.

** Dr. G. **Felli**, Inspecteur en chef supérieur aux Chemins de fer de l'Etat italien.

Lamalle, Directeur général honoraire de la Société Nationale des Chemins de fer belges, Membre d'honneur de la Commission Permanente de l'Association.

R. **Lévi**, Directeur, chef du Service technique des Installations fixes à la Société Nationale des Chemins de fer français.

** O. **Leduc**, Ingénieur en chef du Service technique des Installations fixes à la Société Nationale des Chemins de fer français.

** A. **Donizeau**, Ingénieur en chef, chef de la Division de l'Entretien au Service de la Voie, Région Ouest, Société Nationale des Chemins de fer français.

C. **Lucchini**, Directeur général des Chemins de fer fédéraux suisses.

W. H. W. **Maass**, Advisory Engineer, Office of the High Commissioner for the Union of South Africa (London).

M. **Malderez**, Secrétaire général du Ministère des Communications de Belgique.

** J. **Vrebos**, Directeur général des Transports au Ministère des Communications de Belgique.

A. **Marguerat**, Directeur des Compagnies de Chemins de fer de Viège à Zermatt, Furka-Oberalp, Gornergrat et Schöllenen.

Ing. F. **Marin**, Vice-Directeur général des Chemins de fer de l'Etat italien. (*Excused.*)

** B. **Renda**, Inspecteur en chef supérieur du Service de la Voie des Chemins de fer de l'Etat italien.

** Mario **Fiachetti**, Chef de Département aux Chemins de fer de l'Etat italien.

* Ing. E. **Mellini**, Inspecteur général supérieur au Ministère des Transports (Italie).

** Prof. Ing. U. **Vallecchi**, Directeur général de l'Inspectorat général de la Motorisation civile et des transports concédés (Italie).

** Dr. Ing. E. Roscioni, Inspecteur en chef à l'Inspectorat général de la Motorisation civile et des transports concédés (Italie).

* G. **Olivier**, Directeur général adjoint de la Société Nationale des Chemins de fer belges.

* G. **Pader**, Secrétaire général honoraire de l'Union internationale des Chemins de fer, Conseiller technique attaché à la Présidence du Comité de Gérance de l'U. C. I.

* J. M. **Rivero de Aguilar**, Directeur général du Réseau National des Chemins de fer espagnols. (*Excused.*)

** A. **Moreno**, Ingénieur en chef du Département de l'Exploitation du Réseau National des Chemins de fer espagnols.

* F. **Steiner**, Vice-Directeur de l'Office fédéral des transports. (*Excused.*)

** E. **Branger**, Directeur des Chemins de fer Rhétiques. Membre du Conseil d'Administration des Chemins de fer fédéraux suisses.

* E. D. **Terkelsen**, Directeur général des Chemins de fer de l'Etat danois.

** N. **Johnsen**, Directeur de l'Exploitation des Chemins de fer de l'Etat danois.

** S. **Thorning Christensen**, Ingénieur en chef supérieur des Chemins de fer de l'Etat danois.

* J. C. L. **Train**, Member of the Railway Executive (British Railways).

** J. **Taylor Thompson**, Civil Engineer, N. E. Region, Railway Executive (British Railways).

* E. **Upmark**, Directeur général des Chemins de fer de l'Etat suédois. (*Excused.*)

** J. **Björk**, Directeur adjoint à la Direction générale des Chemins de fer de l'Etat suédois.

** Thorsten **Prambers**, Directeur adjoint à la Direction générale des Chemins de fer de l'Etat suédois.

* J. **Vanderborght**, Directeur du Service de l'Exploitation de la Société Nationale des Chemins de fer belges.

** G. **Moulart**, Ingénieur en chef, Chef du Service technique à la Direction de l'Exploitation de la Société Nationale des Chemins de fer belges. (*Reporter.*)

* G. **Willaert**, Conseiller à la Direction générale de la Société Nationale des Chemins de fer belges.

LOCAL ORGANIZING COMMISSION

President :

R. da Costa **Couvreur**, Président du Conseil supérieur des Travaux Publics au Ministère des Travaux publics et des Communications (membre de la Commission Permanente de l'Association).

Secretaries :

Rogério V. **Ramalho**, Directeur général des Chemins de fer au Ministère des Travaux Publics et des Communications.

Carlos **Manitto Torres**, Ingénieur de 1re classe à la Direction générale des Chemins de fer au Ministère des Communications.

Members :

Ing. Roberto **Espregueira Mendes**, Directeur général de la Compagnie des Chemins de fer portugais.

Ing. Inspecteur Antonio Passos **de Oliveira Valença**, Président du Conseil supérieur des Transports terrestres au Ministère des Communications.

Dr. Antonio Amaral **de Figueiredo**, Président du Conseil d'Administration de la Société Estoril.

Ing. Francisco de Paula **Leite Pinto**, Administrateur de la Compagnie des Chemins de fer portugais.

Antonio **Montez**, Chef des Services de Tourisme et de Publicité de la Compagnie des Chemins de fer portugais.

Antonio de Eça **Queiroz**, Sous-Directeur du Secrétariat National d'Information.

Lt.-Col. Julio **de Abreu Campos**, Représentant de la Compagnie des Wagons-Lits au Portugal.

REPORTERS.

J. Ch. **Bogarim**, Chef de Répartition à la Direction Générale des Chemins de fer portugais. (*Special Reporter.*)

B. **Cassé**, Ingénieur à la Division des Ouvrages d'ar de la Société Nationale des Chemins de fe français.

G. A. **Dalton**, Chief Electrical Engineer, South Africa Railways.

A. **Gonon**, Ingénieur en chef, Chef de la Division d l'Entretien du Service de la Voie et des Bâtiments Région du Nord de la Société Nationale des Che mins de fer français.

R. P. **Sonneville**, Ingénieur adjoint au Service techni que des Installations fixes de la Société National des Chemins de fer français. (*Adjoint* à M. Go non.)

A. d'**Arbela**, Ingénieur, Chef du Bureau des Etude de Locomotives des Chemins de fer de l'Eta italien. (*Special Reporter.*)

Dr. J. Faria **Lapa**, Chef de la Division Commercial de la Compagnie des Chemins de fer portugais (*Excused* and replaced by Mr. J. Santos.)

J. **Santos**, Ingénieur, Sous-Chef d'Exploitation à l Compagnie des Chemins de fer portugais.

Dr. E. **Meyer**, Ingénieur en chef adjoint de la Division de la Traction et des Ateliers de la Direction générale des Chemins de fer fédéraux suisses.

G. **Moulart**, Ingénieur en chef, Chef du Service technique à la Direction de l'Exploitation de l Société Nationale des Chemins de fer belges.

V. A. M. **Robertson**, Chief Civil Engineer, Southern Region, British Railways.

P. H. **Sarma**, Director of Wagon Interchange and General Secretary of the « Indian Railway Conference Association » (India).

BUREAUX OF THE SECTIONS.

SECTION I. — **Way and Works.**

President :

Robert **Lévi**, Directeur, Chef du Service technique des Installations fixes de la Société Nationale des Chemins de fer français. (Membre de la Commission Permanente.)

Vice-presidents :

C. **Lucchini**, Directeur général des Chemins de fer fédéraux suisses. (Membre de la Commission Permanente.)

Arthur Meyrelles **de Campos Henriques**, Sous-Directeur de la Compagnie des Chemins de fer portugais.

Principal Secretary :

Dubus, Ingénieur en chef de la Société Nationale des Chemins de fer belges.

Secretaries :

Bréchot, Ingénieur à la Société Nationale des Chemins de fer français.

. E. **Constant**, Engineer, Personal assistant to the Chief Civil Engineer, Southern Region, British Railways.

g. José **Perestrelo Guimarais**, Sous-Chef de service à la Compagnie des Chemins de fer portugais.

SECTION II. — **Locomotives and Rolling Stock.**

President :

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Secretaries :

Bonnefon, Inspecteur divisionnaire de 1re classe au Service technique du Matériel et de la Traction de la Société Nationale des Chemins de fer français.

Eyre A. W. **Turbett**, Assistant Chief Mechanical Engineer, Southern Region, British Railways.

J. Lopes **Montoya**, Ingénieur adjoint du Matériel et de la Traction de la Compagnie des Chemins de fer portugais.

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J. H. **Glendinning**, District Engineer, Railway Executive, Eastern Region, British Railways.

Ing. Carlos **Santos**, Chef de service adjoint à la Division Commerciale de la Compagnie des Chemins de fer portugais.

List of questions selected for the Agenda of the 15th Session (Rome 1950).

1st Section :

WAY AND WORKS.

I. — Modern tendencies in the building of railway structures, especially bridges.

Results obtained in the construction of railway bridges in reinforced concrete.

Future prospects of the pre-stressed concrete.

II. — Rail-joints : improvements in fish-plated joints.

Use of long welded rails : optimum length in relation to the safety and good conditions of the permanent way.

Expansion gaps. — Determination of standard allowances.

III. — New technical methods adopted for the design and construction of large marshalling yards.

Lay out and equipment :

- — Site and importance of siding groups;
- — Lay-out of connections at entrance to groups;
- — Longitudinal and cross sections;
- — Braking installations (Retarders);
- — Control of point (switch) operation;
- — Telecommunications;
- — Lighting;
- — Staff buildings, etc.

2nd Section :

LOCOMOTIVES AND ROLLING STOCK.

IV. — The comfort of passengers in coaches, railcars and electric motor coaches :

- — Sound proofing;
- — Lighting;
- — Heating, air conditionning, ventilation, thermic isolation;
- — Upholstery;
- — Running stability (type of bogie and suspension.)

V. — Improvements in the construction of rolling stock (motor and trailer) in view of increasing the mileage between repairs :

- — Solid wheels or with tyres (metal used for the tyres and solid wheels, behaviour in service);
- — Axle boxes;
- — Wearing and friction metals;
- — Springs (qualities, shape, manufacture).

VI. — Comparative study of the different types of transmission between motors and axles of electric locomotives, electric motor coaches and Diesel-electric railcars.

Effect on the track of the types of bogies and systems of motor suspension.

3rd Section :

WORKING.

VII. — Organizing methods to be used in large marshalling yards and terminals, to reduce to the minimum the cost per wagon shunted.

— Determination of the staff and number of shunting engines needed;

— Capacity and control of the efficiency of the marshalling yards;

— Recording and numbertaking arrangements in the arrival and departure yards;

— Statistics and traffic analysis by the control-room;

— Braking and retarding arrangements;

— The formation of trains for departure.

VIII. — In view of the ever increasing weight of road competition, what are the most appropriate measures, apart from reduced rates, for keeping traffic by full wagon loads in the hands of the railway?

Would not road transport at the end of the railway journey be justified in order to get direct contact with clients who are not connected up by railway sidings?

Should not the road vehicles required to assure such transport be attached to central stations, equipped with suitable handling equipment, from which the road transport services would start?

Choice of the vehicles to be used.

IX. — Modern safety and signal installations (centralising apparatus for block system and signals).

Central electric apparatus with individual levers and « all relay » levers (all electric interlocking).

Automatic block-system with continuous current and coded current.

Light and speed signalling.

4th Section :

GENERAL.

X. — Drawing up the financial balances regarding passenger and goods services taking into account the prime cost of trains : per category, per line and per type of motive power.

Principles and methods of calculation.

XI. — Organisation and development of medical and social services with partnership of the staff in their management.

XII. — What must the importance and the prevailing conditions of traffic be, in order that from the economic point of view :

a) the construction of a railway line;

b) the keeping operating an existing railway line,

should be useful?

5th Section :

LIGHT RAILWAYS AND COLONIAL RAILWAYS.

XIII. — Modernisation of the maintenance methods of the permanent way on the light railways.

XIV. — Change over from steam locomotives traction to Diesel traction.

XV. — Signalling on single line sections.

[621 .392 (494) & 625 .143 .4 (494)]

The welding of rail joints by the « Sécheron » process,

by F. WÖRTMANN, Dr. Ing. and R. MÜLLER, Ing. E.P.Z.

(*From the Sécheron Bulletin nº 18F.—1946.*)

This is a description of a new process for welding rail joints. The authors set forth briefly the researches that they have made on the subject and describe the application of the process, which can be carried out on the permanent way itself with the minimum of equipment, does not require the traffic to be interrupted, and allows of welded joints being obtained having a limit of resistance of the order of 25 kgr./mm² (15.87 tons per sq. inch.). The « Sécheron » joint can be welded by means of direct current or alternating current of either 50 or 16 2/3 cycles. In conclusion, particulars are given of the results achieved on the Zug-Baar section of the Swiss Federal Railways.

For many years past now, it has been customary for railway rails to be 9 or 12 m. ($29'6^3/_8''$ or $39'4^1/_2''$) long. This figure was determined on the one hand by the weight of the blooms which had to be rolled, and the facilities available for transporting the rails and handling them in service on the other. At the present time, when laying new track or replacing worn rails, lengths of 18 to 36 m. ($59'^5/_8''$ to $118'1^1/_4''$) are being used.

The rails rest on sole plates and are attached to the sleepers by means of bolts or coachscrews. The joint is generally reinforced by fishplates, secured by means of four or six bolts (fig. 1).

On account of the lesser resistance offered by the fishplates, the load gives rise to a greater amount of deflection at the joint than elsewhere along the rail. This deflection and the gap between the rail ends produce, as the load passes, a shock to the rail and the vehicle moving over it. By looking attentively at the rail as a train is passing, it can be seen that its deflection is accompanied by a movement of the sleepers, which rest more or less firmly on the ballast.

The joint has to perform the important function of allowing for the expansion and contraction produced by changes in temperature. Under a strong sun the rails can attain a temperature which makes it almost impossible to touch them. During cold nights they assume the ambient temperatures, which in Switzerland frequently falls to — 20° C. (— 5° F.). If this temperature and + 60° C. (+ 140° F.) are taken as limiting figures, we find that the variation in length over a distance of 100 m. ($328'1''$) attains 9.6 cm. ($3^{47}/_{64}''$) or 3.5 cm. ($1^{25}/_{64}''$) per length of 36 m. ($118'1^1/_1''$). As the rails can expand, in spite of the fixing screws and fishplates, a sufficient gap between them is provided when the track is laid.

If now we were to take it that the permanent way had been laid complete in one piece, without any joints at all, at a temperature of + 10° C. (+ 50° F.) we should find that at + 60° C. we should have a compressive load reaching as much as 12.9 kgr./mm² (8.190 tons per sq. inch) (80 tonnes for the entire cross section of the rail) and at — 20° C. we should have a tensile load of 7.75 kgr./mm² (4.92 tons

per sq. inch) (48 tonnes for the entire cross section of the rail). The rails would support these loads easily and there would be no danger of buckling if the track were perfectly straight and the sleepers held firmly in place by the ballast. This opinion finds confirmation in the fact that in the United States certain straight sections of line are welded over 1 km.

Fig. 1. — Rail joint with angle bar type fishplate. The load imposed by a passing vehicle produces a deflection of the joint. As a wheel passes from one rail to the other a shock or jolt is produced, which causes wear to both rail and vehicle.

(3 280′10″) distance. On curved sections of line, on the other hand, it is not possible to weld the rails over such a length without producing a transverse displacement of the sleepers unless they are very solidly anchored to the ground, which it would be too expensive to effect. For this reason the greatest length of rail at present permitted in Switzerland is 36 m.

The deflection of the rail under load gives rise to friction between it and the fishplates; this results in wear and it becomes necessary to tighten the fishbolts from time to time. The fatigue effect produces in addition after a certain interval, cracks in the fishplates, which occur fairly frequently and necessitate replacements. When a wheel passes from one rail to the next, a shock is produced, in the rail and in the vehicle. These repeated shocks finally result in wear on the rail in the vicinity of the joint, and it sometimes happens that the rail becomes bent. On double lines the end of the rail facing the direction of traffic wears more rapidly than the other.

For the purposes of this article, we need not dwell on other features of wear on the track.

From the few facts which we have just set forth, it will be clear that the main-

tenance of railway permanent way is very expensive. To make good the wear in the rails the ends are as a rule set up and any excess in height is ground off. This process has been of late years replaced by electric arc welding, by means of which the worn rails are built up.

Whatever process is adopted however, the maintenance continues to be costly, which has led railway managements to taining the track and rolling stock, and allows passengers to travel in greater comfort.

Safety being the first concern of railway managements, the requirements to be fulfilled by a welded joint are of a very high standard. They are not limited merely by the resistive power of the welding. It is necessary too to be able to carry out the work on the line without producing

Fig. 2. — Welding joints in bad weather. The workmen protect themselves from its effects as much as possible. The « Sécheron » type joint has been developed so as to be unaffected by small defects in the welding brought about by the working conditions.

reduce the number of joints and to weld several rails of comparatively short length into one long one.

The Swiss main lines are laid at the present time with 12 m. ($39'4^1/_2''$) or 18 m. ($59'^5/_8''$) rails; we have seen above that 36 m. ($118'1^1/_4''$) is the maximum permitted. Three 12 m. or two 18 m. rails are therefore welded to form a single 36 m. rail.

This reduction in the number of joints to one half or one third of what they were, noticeably reduces the cost of maintenance.

any noticeable disturbance or any interruption in the traffic. The welding must also be capable of being carried out in unfavourable atmospheric conditions without the quality of the work being affected. The welders have in fact to work on very hot days, in the rain, during a violent wind or heavy falls of snow (fig.2). Intense cold alone interrupts the work.

The Sécheron joint.

It was with all these conditions in mind that the investigations were undertaken

which were to result in the perfecting of the « Sécheron » joint. Their object was to find a joint offering a limit of resistance noticeably greater than that of the processes known hitherto, while making use of arc welding, which has the definite advantage of rendering it easy to do the work out on the line. Taking into account too that the majority of the electrified routes in Switzerland are operated on single phase current at 16 2/3 cycles, we had to be able to weld with either direct current or alternating current at either 50 or 16 2/3 cycles.

We also endeavoured to take account of the fact that when welding out on the line it is impossible altogether to avoid certain defects arising. It became necessary therefore to render the resistive power of the joints practically independent of small welding imperfections (*). It might seem out of the question to achieve this, as it is well known that the power to resist fatigue is dependent on just these very defects, however small they may be. It was necessary to find the solution of this problem in some form of strengthening, by increasing the cross section of such parts of the joint in which small defects in the welding could become a source of real danger.

It is however generally admitted that a change in cross section does not increase the resistance of a weld to fatigue and that on the contrary, such has to be removed by grinding. Thus the specifications for high pressure piping and reservoirs call for the removal of all projections at the welds if high stresses are to be permitted.

(*) The first experiments were made by bending the rails in a press. Later a falling weight was used, dropped from a certain height. Weight and height served as a standard for determining the resistance of the rail. These methods did not, however, correspond to the stresses to which a joint is subjected out on the track. At present the limit of resistance is measured by subjecting the joint to a load of known value, repeated at least 1 000 000 times.

We have found, however, in the course of a thorough investigation into the phenomena of breakages caused by fatigue, that premature failure of a joint is brought about chiefly by the grooves made by the arc alongside the deposited welded material. The reinforcement itself is only harmful if the change of section at the extremities of the weld is abrupt.

Before designing a form of joint reinforcement, it is necessary to know the effect of the change in structure of the metal at the edge of the weld on the resistance to fatigue. It is generally thought that this point is a weak one, on account of the change in structure. The opinion is partly justified, as we shall see later on. In the case of ordinary steel « Sécheron » has been studying this problem for some years now, in collaboration with the Federal Experimental and Test Laboratory (L. F. E. M.) at Zurich. We propose to describe briefly the observations we have been enabled to make there.

It was found possible to obtain practically the limit of resistance possessed by the basic metal by making a gradual transition between the normal and the strengthened cross sections. To find out what the size of the reinforcement should be, the relationship between the tensile figures for the basic material and the weld material was taken as a basis. This is of the order of 5 to 3, corresponding to 25 kgr. and 15 kgr. per mm² (15.87 tons and 9.523 tons per sq. inch).

The first reinforcement of an ordinary mild steel joint was carried out by turning back the ends of the plates in an endeavour to eliminate the possible harmful effect of change in structure. Samples of varying thickness, 10, 25 or 40 mm. ($^{25}/_{64}$", $^{63}/_{64}$" or $1^{37}/_{64}$"), were subjected to a fatigue test and it appeared that the creases produced in the surface of the metal by the process of turning it back had an adverse effect on the resistive power of the joints. This reached however a figure of 22 kgr./mm² (13.97 tons per sq. inch) and when the creases were

ground away it reached 27 kgr./mm² (17.14 tons per sq. inch).

In spite of these satisfactory results, it was necessary to find another reinforcing process because to turn the metal back is generally impossible in practice, or at least very difficult. An attempt was then made to form a reinforcement of similar shape by the building up process. This method naturally resulted in altering the structure of the basic material at the beginning of the reinforcement. Indeed arc welding always brings about a change in the structure of rolled steels in the direction of a cast metal structure. The built up pieces were then machined to obtain the form shown in fig. 3. The rest of the reinforcement was welded like an ordinary X type of weld. The limit of resistance reached a figure of 23.5 kgr./mm² (14.917 tons per sq. inch); this could be improved somewhat by hammering the edges of the built up parts before machining. It then reached 26 kgr./mm² (16.51 tons per sq. inch), equal to that of the basic metal.

The tests showed clearly that the change in structure of mild steel has only a very slight effect on resistance to fatigue; as proof of that we point out that the resistance of built up joints is practically the same as when made by turning back the ends, if the shape of the two reinforcements is the same.

To make use of these data to solve the problem of welding rail joints was hardly possible. It was in fact necessary to take into account the quality of the rail steel, a steel containing about 0.3 — 4 % C; 0.03 — 0.06 % S; 0.03 — 0.07 % P, and 0.5 — 0.7 % Mn. Steel of this quality is reported to be very sensitive to tempering. This characteristic results in the formation of martensite if the rail cools rapidly after the welding, and this has objectionable effects. It imparts to the piece so treated in fact a strong tendency to form cracks, which lowers its limit of resistance. This fact has been evident throughout all our investigations.

These led us to make tests of many

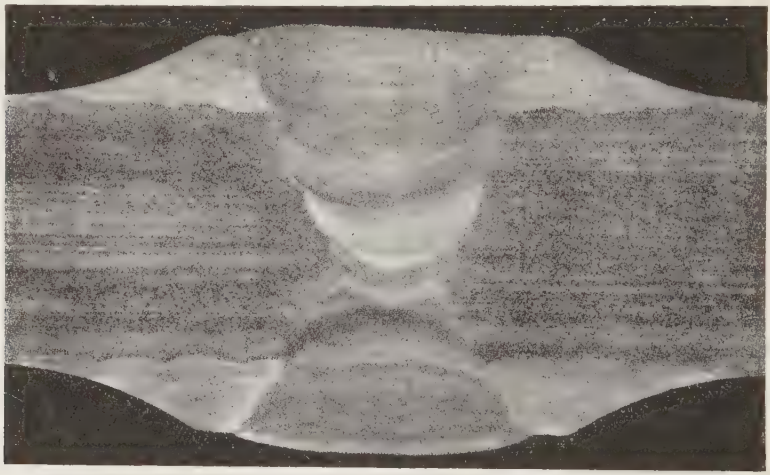
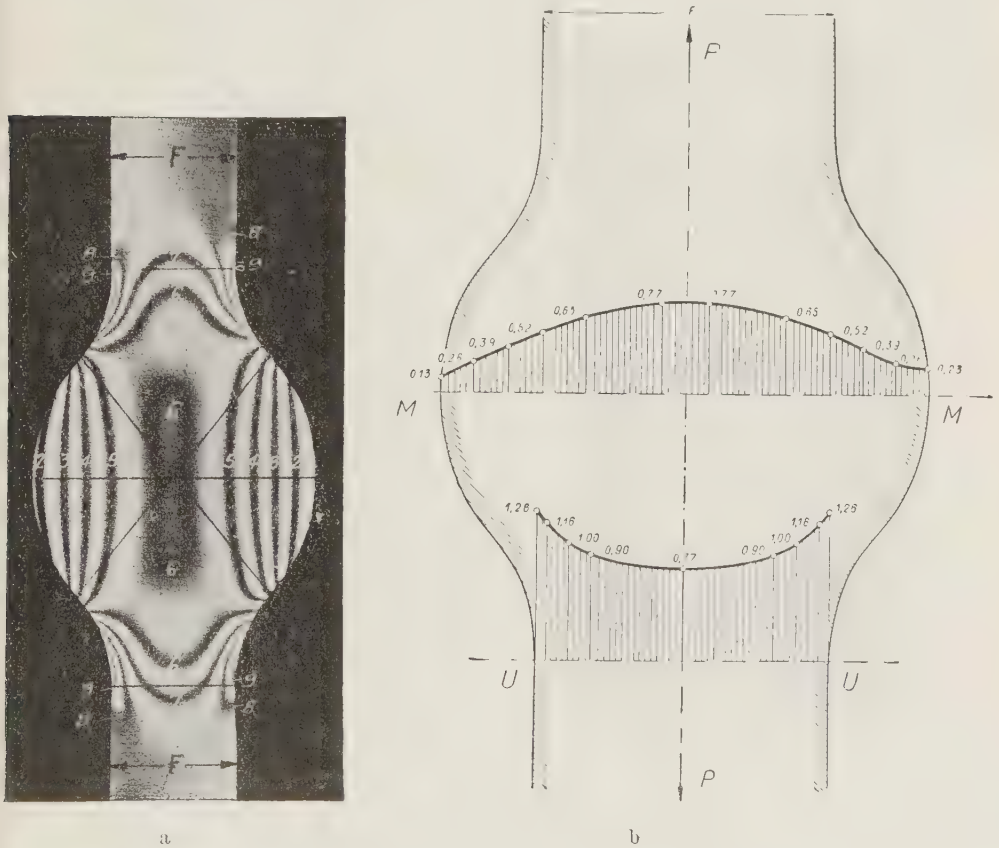


Fig. 3. — The reinforced « Sécheron » type joint intended to offer high resistance to fatigue. The resistant properties of the weld can be made to equal practically that of the plates themselves by building up the joint so as to strengthen it and then machining it. This form of reinforcement used for building was the basis for our research works for welding rail joints.

forms of rail joint. Simple electric arc welding without any reinforcement enabled us to meet the requirements of the Swiss Federal Railways, which called for a limit of resistance of 18.7 kgr./mm² (11.874 tons per sq. inch). This was only attained with welds free from pores and defects. It is not to be expected, however, that workmen will weld regularly out on the track, when their conditions of work are often very uncomfortable, without producing any defects. The welder operates in an unfavourable position; he cannot move the rails and he must work in all weathers

An endeavour was then made to get a joint offering every guarantee for satisfactory service by depositing with the aid of welding a large and strong reinforcement on the upper face of the foot of the rail. The results were not entirely satisfactory, and were above all very irregular. The breakages started as a rule at the lower face of the rail foot, underneath the web; this is in fact the area



a b

Fig. 4. — *a*) Photo-elastic examination of a « Sécheron » type joint, symmetrically reinforced. *b*) Distribution of the tensile stresses in the cross section of the joint; the stress reaches 1.25 at the edge and 0.77 at the centre, if 1 be taken as the mean value for the plate itself.

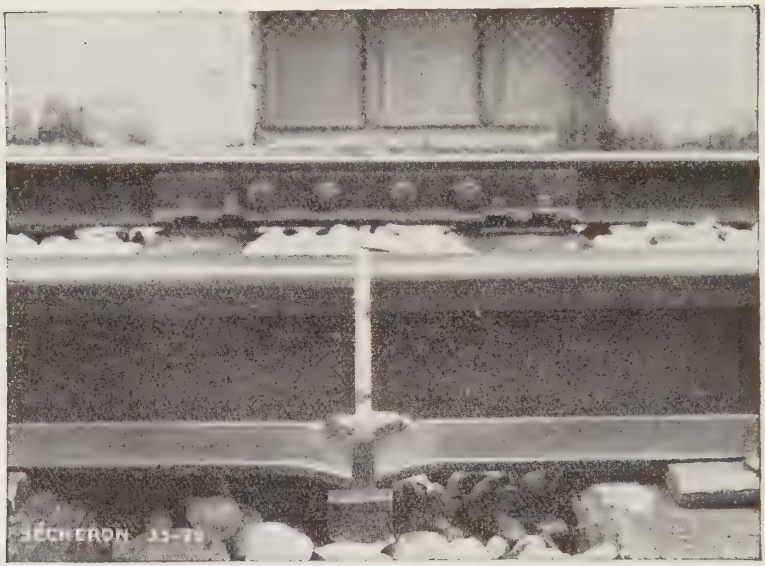


Fig. 7. — Preparing to make a « Sécheron » joint. The web of the rail is cut away for about 2 cm. (25/32") and after heating, the foot of the rail is bent downwards for 10 mm. (25/64"); a copper block is placed beneath the joint for the welding of the first layer.

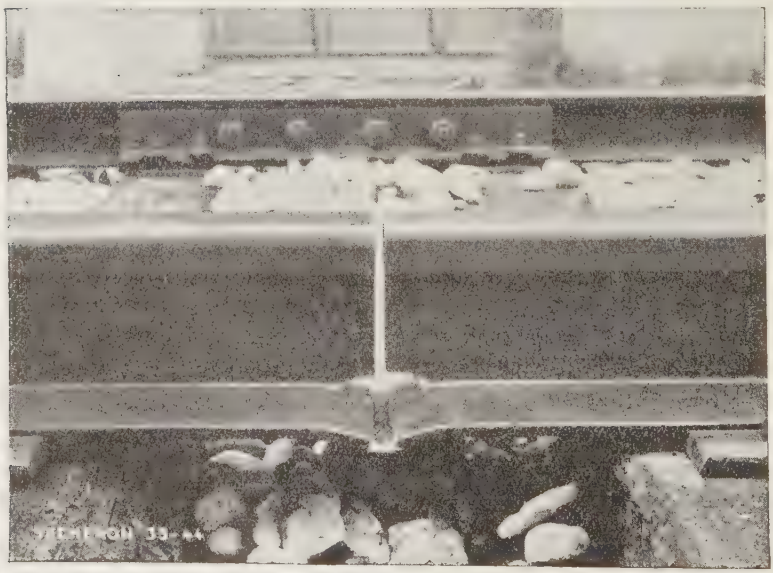


Fig. 8. — The first layer has been deposited with the aid of BOR-S 38 type electrodes. The dross has been got rid of and the copper block removed, allowing the layer to be inspected on both faces.

ed V bevel. The ends of the feet should be at 10 to 15 mm. ($^{25}/_{64}$" to $^{19}/_{32}$") from one another. The head of the rail can also be bevelled out in V form. This is, however, not necessary, as a competent welder can work easily with the rail faces parallel.

Welding the rail foot.

After the rail foot has been prepared, the welder makes firm below the joint a copper block of suitable shape, which may have in it a groove 12 mm. ($^{15}/_{32}$") wide and about 2 mm. ($^{5}/_{64}$") deep. He then deposits in the normal position the first layer of material using a BOR-S type electrode, 3.8 or 4.6 mm. ($^{5}/_{32}$" or $^{23}/_{128}$") diameter. He clears away the dross and removes the copper block in order to observe with the help of a mirror the lower appearance of the first layer. This is a very useful step, as we have found, in the course of experiment, that all the serious mistakes were made while putting on the first layer. If the welder carries this out properly we can agree that he will weld the rest of the joint in like manner. This examination concluded, the welder puts the copper block back in place and proceeds without further interruption to build up the reinforcement to the necessary depth. To do this he uses if possible 5.5 mm. ($^{57}/_{256}$") diameter electrodes. An experienced welder is able to effect the whole reinforcing process without removing the dross with the hammer; it is sufficient if he makes the slag run to the edges of the rail. The strengthening metal must be deposited in such a manner as to form a symmetrical reinforcement when machining is completed. The surplus height on the upper face should never exceed 7 mm. ($^{9}/_{32}$"). The welder must see that he does not overheat the

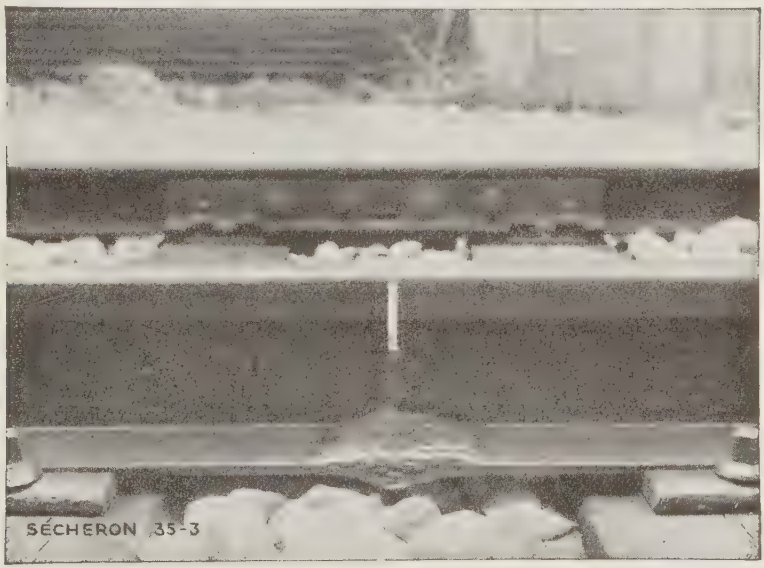


Fig. 9. — The welding of the foot of the rail has been completed. The reinforcement is deposited without any interruption and without getting rid of the slag which the welder drives towards the edges as he welds. During the process the foot of the rail becomes heated to redness.

rail during the process, which would cause the reinforcing metal to run with the slag. This running or the flashing of sparks at the surface of the weld would render the last named extremely porous. We may point out finally that too much metal must not be deposited at the edges of the reinforcement or the machining will be rendered too awkward.

eliminate the danger of creating porosity. Welding in the vertical position is easy and we have not met a welder who experienced difficulty under these conditions.

Welding the rail head.

Having removed the copper block used in welding the web, the welder places two

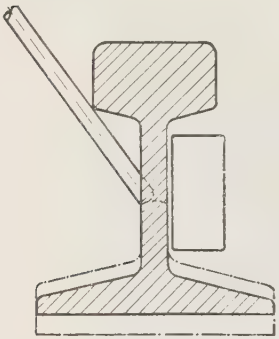


Fig. 10. — Cross section of rail prepared for the welding of the web. A block of copper is placed on one side and the electrode operated on the other or free side.

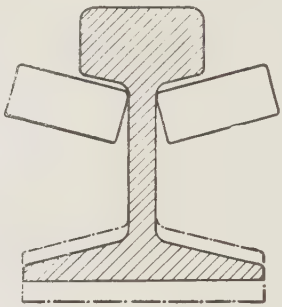


Fig. 11. — To weld the rail head, two blocks of copper, of adequate form, are placed in position, leaving a space between them and the rail head of about 2 mm. (5/64") to allow the slag to flow.

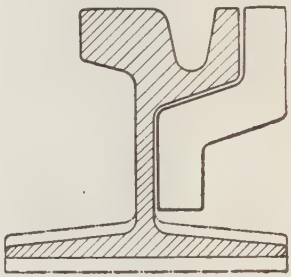


Fig. 12. — Welding of groove type rails. The block of copper used in connection with the welding of the web is used also when welding the check lip. When welding the running tread, the process is the same as with the ordinary flat-bottom rail.

Welding the rail web.

The distance between the two end faces of the rail is some 10 to 15 mm. ($^{25}/_{64}$" to $^{19}/_{32}$"). The electrode can therefore be applied on one side of the web of the rail while the other is flanked by the copper block (fig. 10). For this stage in the process the welder uses 3.1 or 3.8 mm. ($^{33}/_{256}$" or $^{5}/_{32}$") electrodes. As in the case of welding the rail foot, he follows up the slag and welds continuously. The welding current should not be too heavy as the heat dispersion in the web is poor; the welder has also to avoid making the supporting metal run with the slag, to such pieces in place (fig. 11) for dealing with the head. He has to be careful to leave between the underside of the head and these pieces a space of about 2 mm. ($^{5}/_{64}$") which will allow the slag to run, thanks to its fluidity. The metal, much less viscous, does not run. It is good practice to clear away the dross after the first layer. The welder can then finish welding the head by following up the slag. He should fix the strength of the current at a value less than that used when welding normal items of the same dimensions as the rail head, as the latter gets hot rather rapidly.

Fig. 12 shows the shape of the copper

Fig. 13. — Completed « Sécheron » joint.
The lower and upper faces of the reinforcement are symmetrical.

Fig. 14. — Inspecting the lower face of the foot of the rail, facilitated by using two mirrors, one of which reflects light on to the face.

block used when welding the web of tramway rails. This also allows of welding a portion of the rail head which is finished off in the same manner as with the Vignoles type of rail.

The « Sécheron » process has the advantage of keeping the rail at a high temperature during welding, which eliminates the danger of welding on rails which are too cool.

Practical application of it has proved that the greater number of workmen who take up welding out on the line lack experience. They deposit the metal very irregularly when putting the first layer between the two feet and create at times small grooves along the lower protuberance. To eliminate this possible danger this area is made a little less built up, which is done by placing it at a greater distance (10 mm. = $^{25}/_{32}''$) from the normal line of the foot than the upper part of the reinforcement (7 mm. = $^{9}/_{32}''$). It is therefore advisable when beginning to use the process, to call for a bending of the foot of 10 mm.

Inspection of the joint is effected in two stages. First of all it is necessary, immediately the first layer is welded on, to inspect the underface of the rail foot. Then the completed joint must be examined, after machining, which must itself be so carried out that the upper face and corners of the reinforcement show no sign of the transition between the rail and the supporting additional metal visible to the naked eye.

To weld by the « Sécheron » process the amount of equipment required is very small; we have one copper block with groove for the welding of the foot which must be wide enough and thick enough to ensure that it does not attain to too high a temperature and begin to run, which would be dangerous, since the resultant copper-iron combination would be very brittle and crack easily.

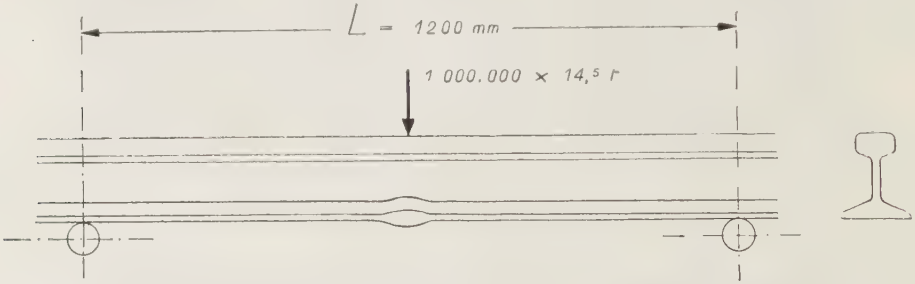


Fig. 15. — Fatigue tests on a welded rail joint. The distance between centres is 120 cm. (3'11 1/4") and the load varies between 1 and 15.5 tonnes for the No. 1 Rail Section, Swiss Federal Railways. Each time load is applied a deflection of some 3 mm. (1/8") is produced.

Then one piece of copper is needed for the welding of the web and two for the head of the rail. These are subject to a lesser temperature than the other, as the welder applies shorter layers with a weaker current.

A cutter and a burner of large size are required for preparing and pre-heating the joint. The outfit is supplied from bottles of dissolved acetylene or a calcium carbide generator.

Templates, hammer and wedge are necessary to effect the bending of the rail foot. A grinder also is required, indispensable to all renewal work on the permanent way.

The number of electrodes needed to weld a « Sécheron » joint varies between 30 and 35 pieces of the BOR-S type 38

and 46 or 55. In spite of this relatively high number, the work is effected rapidly because the welder deposits the layers without getting rid of dross. The welding of the rail foot alone requires about 25 electrodes. Obviously a few could be saved by placing pieces of iron in appropriate places, for example prepared pieces, when reinforcing the foot.

The tests which we made when applying this method gave good results. (Limit of resistance 24 kgr./mm² = 15.24 tons per sq. inch.) We must make it clear however that to give these pieces the appropriate shape and place them in the right place requires the person responsible to have a considerable knowledge of this class of work. Any mistake, always liable to be made, brings about a disturbance in the stressed area inside the reinforcement and can give rise to premature breakage of the joint. It is for this reason that this method is not for the moment being made use of, but probably it will be later.

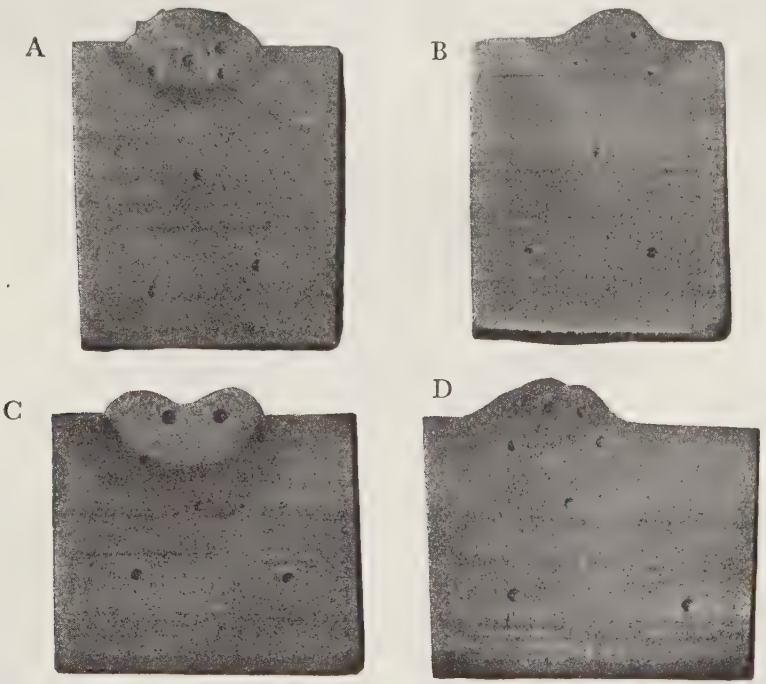


Fig. 16. — Macrographs of layers deposited on rails. We see that if the rail is not pre-heated (A and B), narrow and very hard transitional areas are produced, whereas pre-heating allows of larger areas, though less hard (C and D). The greatest hardness is obtained by welding with a BOR-S type electrode on a cold rail.

Tests and practical applications.

In the spring of 1945, the Electrical Engineering Department of the Swiss Federal Railways, Second Division, undertook a number of welding tests using a frequency of 16 2/3 cycles. These were carried out in the Olten Workshops under the supervision of the Federal Testing and Materials Laboratory (LFEM) and

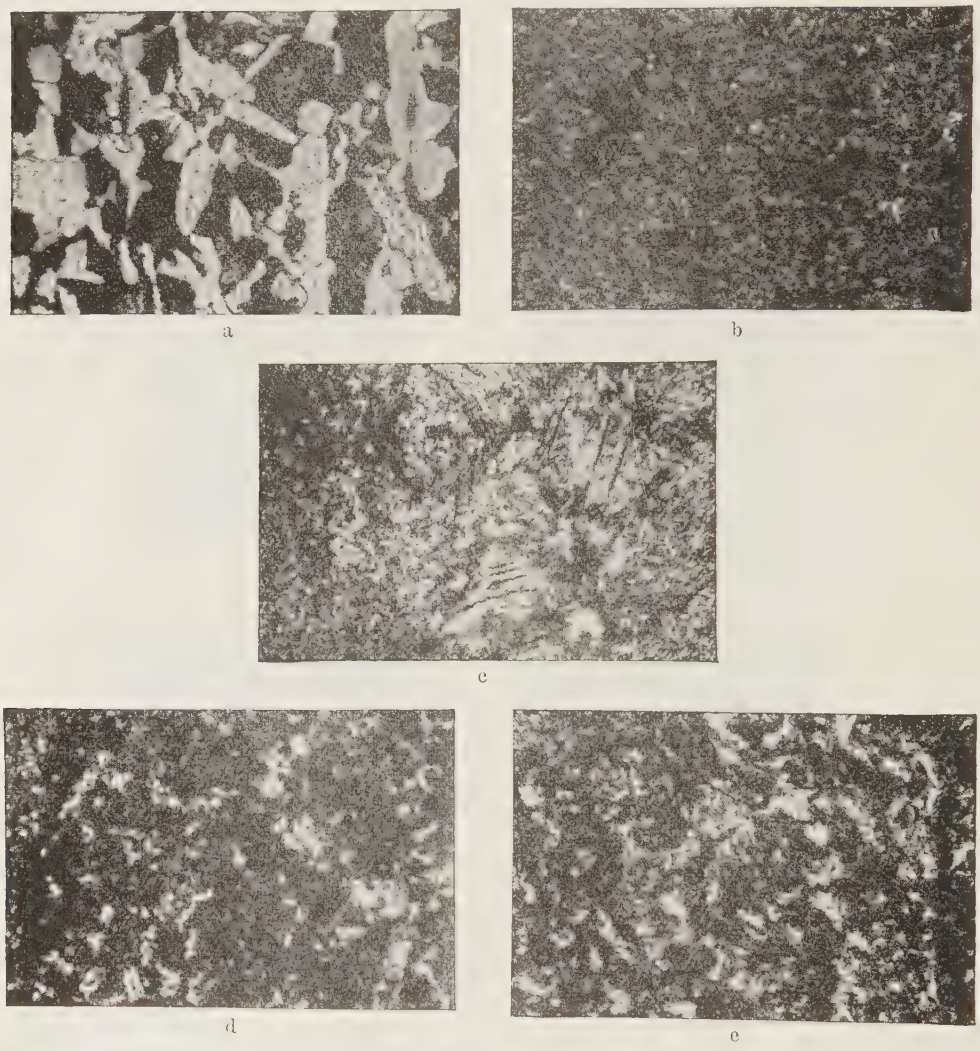


Fig. 17. — Microphotographs of : *a*) an ordinary rail; *b*) reinforcing metal deposited on a cold rail; *c*) transition area on a rail welded cold; *d*) metal deposited on a pre-heated rail; *e*) transition area on a rail welded after pre-heating.

an engineer attached to the railways. It was found that using this frequency joints of excellent quality could be obtained. As a conclusion to the tests four « Séche-ron » type joints were welded, which proved to be very capable of resisting fatigue. The following results were obtained :

welded at 16 2/3 cycles, joint No. 1 reached a limit figure of 23.5 kgr./mm² (14.917 tons per sq. inch);

welded at 16 2/3 cycles, joint No. 2 reached a limit figure of 22.5 kgr./mm² (14.314 tons per sq. inch);

welded at 50 cycles, joint No. 3 reached

a limit figure of 26.2 kgr./mm² (16.63 tons per sq. inch);

welded at 50 cycles, joint No. 4 reached a limit figure of 27.4 kgr./mm² (17.39 tons per sq. inch).

These fine results attracted much notice and led the Federal Railways to weld a section of track between Olten and Lucerne. After the completion of the work some joints were removed for testing by the LFEM at Zurich. Contrary to all expectations the results obtained were very varied. An analysis of the conditions of each joint showed that any premature breakages were attributable to serious defects in carrying out the work. This drew the attention of the welders to the mistakes they had made and they were not allowed to weld out on the track again until they had passed an examination, both theoretical and practical.

The Federal Railways Management then gave authority for 80 joints to be welded between Zug and Baar, the work being entrusted to the same concern as had dealt with those on the Olten to Lucerne section. The experience already gained and the courses of instruction given had borne fruit, for the three joints taken up at the conclusion of the work gave excellent results. The inspection of them was once again confided to the LFEM. The limit of resistance reached a figure of 23.0, 25.3 and 27.1 kgr./mm² (14.60, 16.06 and 16.77 tons per sq. inch) respectively.

Fig. 18 illustrates the least good out of the three joints after breakage, brought about by serious faults in the welding. In spite of these the limit of resistance reached a value of 23 kgr./mm² (14.60 tons per sq. inch), superior to that of joints welded out on the track by processes hitherto known, such as the Thermit, the Autogenous, or the various arc welding methods. In view of the excellent results obtained, the Federal Railways authorised the application of the « Sécheron » process to their entire system of lines.

Basing our opinion on the experience we have gained in the inspection of over 100 joints, often welded under very difficult conditions, we are able to assert that the « Sécheron » joint welded out on the line is able to reach regularly a limit of resistance of 27 kgr./mm² (17.14 tons per sq. inch). To achieve this, it is essential:

1. to have trained welders, specially instructed, and to exercise a regular system of inspection, enabling serious defects in the welding to be eliminated: small difficulties, such as porous spots, are of no practical consequence;

2. to pre-heat carefully and maintain the temperature during welding at a minimum figure of 300° C. (571° F.);

3. to grind carefully at the faces where the rail and the reinforcement pass into one another.

When inspecting the joints, it is found that certain breakages do not start in the foot of the rail, which nevertheless is subject to the heaviest stresses, but in the head. This we can explain as follows: — The load occasioned by the passing of a train subjects the rail head chiefly to compressive stresses, although it can also feel the effect of tensile stresses, but relatively light ones, especially if the joint is supported by double sleepers. It is to be noted that breakages in the head can be brought about by compressive stresses quite as much as by tensile ones, and in the course of our tests, we have had several cases of breakages of the former kind. Often they occurred because the head of the rail was badly welded. Too frequently indeed the welders thought they could make sure of a joint having the required resistance merely by the fact of having welded the foot of the rail faultlessly. When doing the head they let their attention relax and the welds showed large inclusions of slag. In fig. 20 on the other hand, is seen the appearance of a correctly welded joint, which has failed in the sound portion of the head under compressive stresses, after 1 300 000 deflections (limit of resistance 18.7 kgr./mm² = 11.87 tons per sq. inch); the complete

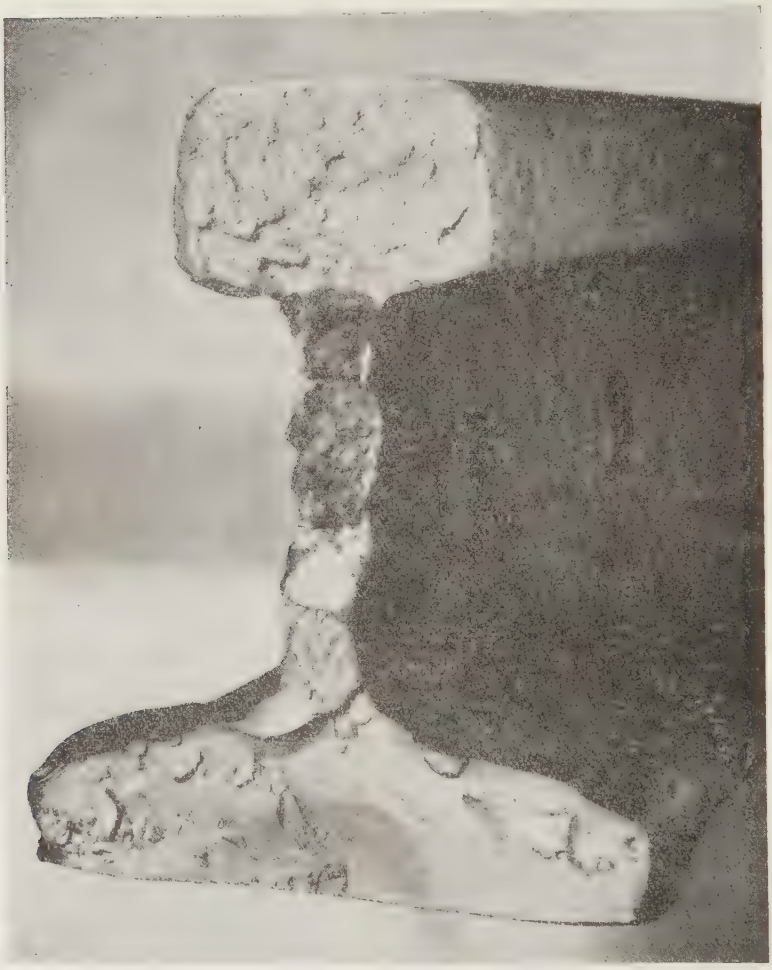


Fig. 18. — « Sécheron » type welded joint, cut out of track between Zug and Baar. The breakage was due to serious defects in the welding. In spite of these the limit of resistance of this joint reached a figure of 23 kgr./mm² (14.60 tons per sq. inch), which is higher than that of other processes for welding joints in position on the track.

breakages of the joint did not occur until 4 000 000 deflections had taken place.

We saw above that the head of the rail was liable to be subjected temporarily to tensile stresses. There is therefore some interest in determining what the resistance of a joint is when the head is subjected to tensile and the foot to compressive stresses, which comes to reversing the rail and placing it head downwards in the fatigue testing machine.

In this position, suitably welded joints attain limit of resistance figures from 20 to 22 kgr./mm² (12.70 to 13.97 tons per

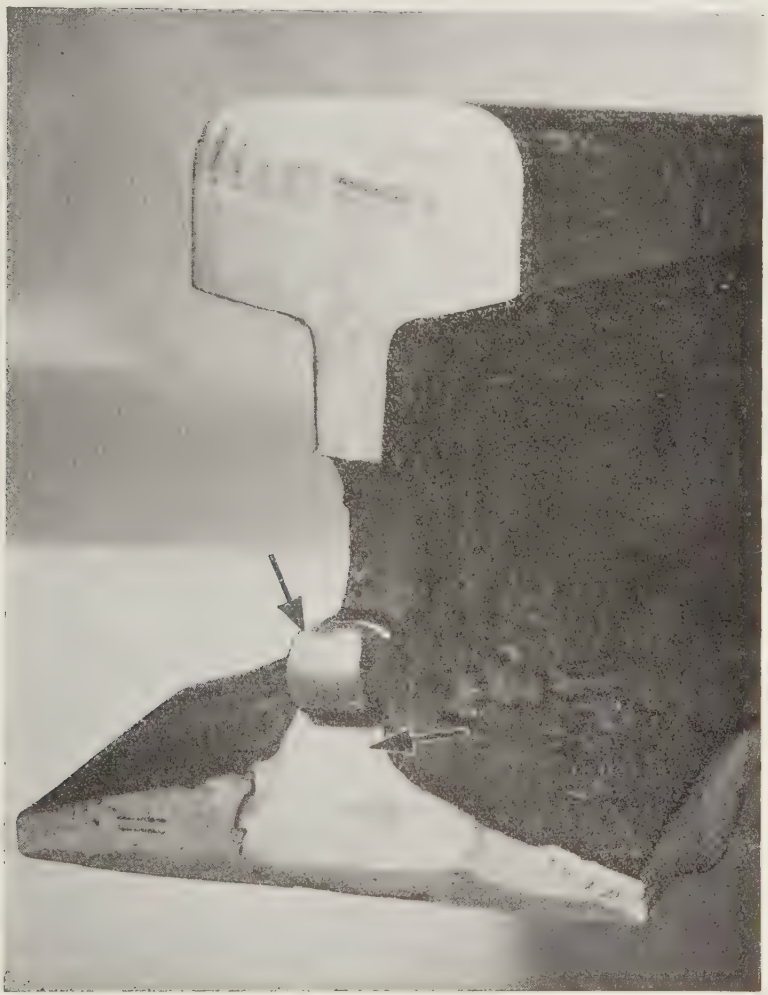


Fig. 19. — Welded joint in the track between Zug and Baar. The welding had been done correctly and the breakage occurred outside the weld. The limit of resistance was 27.3 kgr./mm² (17.33 tons per sq. inch.). The portion above the bolt hole was still intact, and it had to be sawn through to enable the break to be analysed.

sq. inch) which can be improved by strengthening the head.

It often happens that advantage is taken of the joints being welded to build up the rails; special attention then has to be given to pre-heating. If the rail is heated carefully prior to building up the head, the limit of resistance of the joint itself will not be adversely affected. If, on the other hand, building up is effected without the rail being heated specially, the heat imparted by the act of welding the joint

Fig. 20. — Rail joint showing a breakage in the sound portion of the rail head. This was caused by compressive stress and occurred outside the weld after load had been applied 1 300 000 times. The complete joint broke after 4 000 000 applications of load.

alone being used, the limit of resistance falls and varies from 15 to 18 kgr./mm² (9.523 to 11.43 tons per sq. inch). Breakage takes place outside the joint. Tests have shown that the cause of this was martensite, arising from the building up process, without there being any traces of cracks, primary or secondary, arising from the welding of the joint.

The stresses met with by the foot of the rail under traffic are appreciably less than those corresponding to the limit of resistance figures specified by the Federal Railways. The maximum wheel load in

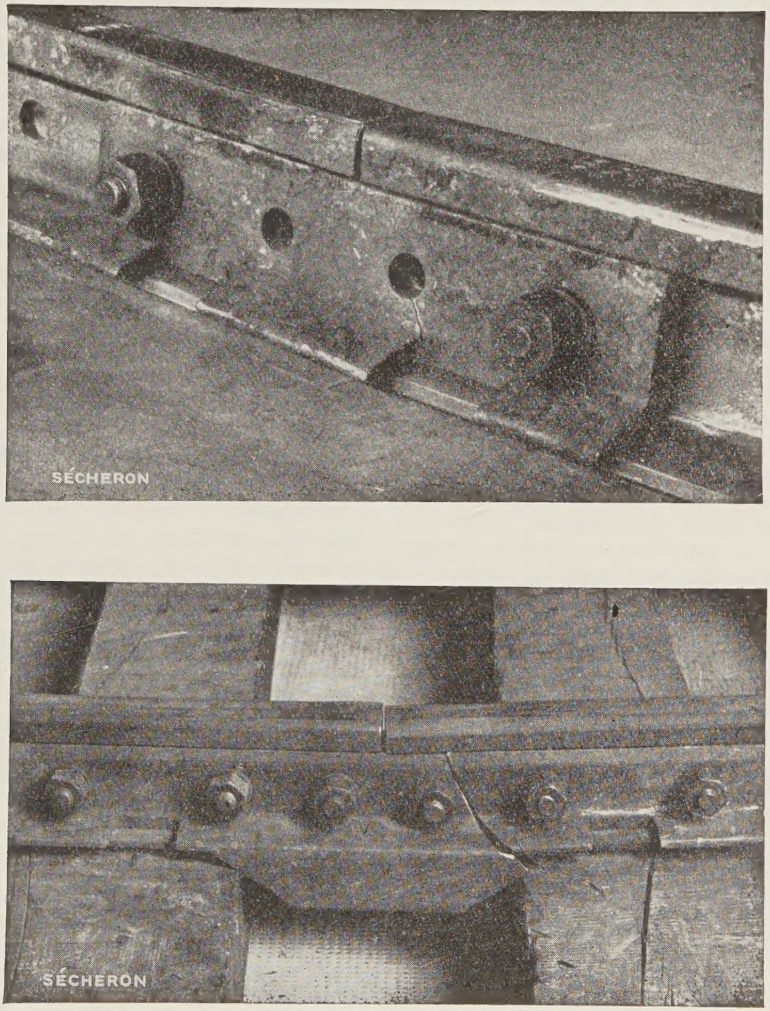


Fig. 21. — Joints fitted with angle-bar and reinforced angle-bar fishplates. Their limit of resistance is very inferior to that of welded joints. The joint with ordinary angle-bar fishplate broke after sustaining 2/3rds of the load specified for welded joints 54 000 times. The reinforced angle-bar joint took the total load 195 000 times.

Switzerland is fixed at 10 tonnes and the sleeper spacing at 65 cm. ($2'1^5/_8''$), whereas the specification covering a welded joint calls for a maximum tensile load of 20 kgr./mm^2 (12.70 tons per sq. inch), which amounts to bringing to bear on a rail of the Federal Railways section No. 1 with the joint centrally placed between centres spaced at 120 cm. ($3'11^1/_4''$), a load of 15.5 tonnes. The minimum tensile

figure is fixed at 1.3 kgr./mm² (0.825 ton per sq. inch) which corresponds to a load of 1 tonne. The difference between the maximum and minimum figures, or 18.7 kgr./mm² (11.87 tons per sq. inch) has to be borne by the joint 1 000 000 times. We should add too that in the case of the tests the rails stand by themselves, whereas in actual practice they are attached to the sleepers, and thus are held at their ends. The loads exerted by the rail foot on the track in this way reach a figure of about 1/5th of that specified.

Service conditions are on the other hand more unfavourable, because the load gives rise alternately to small compressive and large tensile stresses, that is to say it does not vary between positive maximums and minimums, as in the case of the machine used for the tests. These conditions are made even more unsatisfactory when the sleepers are not firmly packed, which may increase the gap between centres to 130 mm. ($4'3^3/_{16}''$), or in those cases where the sleepers are not in firm contact with the ballast until the rail has become appreciably deflected. We may point out in conclusion that the number of times a joint is subjected to load during the life of a rail considerably exceeds a million. On the Geneva-Lausanne section, a line carrying a heavy traffic it is true, a figure of a million is reached in a single year. It is clearly necessary to take account of the fact that the number of wheels exerting a load of 10 tonnes is relatively small and is in fact only met with in the case of heavy locomotives and a few special vehicles.

If a life of 15 years be admitted for a rail and the number of times it is subject to load be taken as 1 000 000 per annum, we get a total of 15 000 000 loads. Applying the empirical rule which says that the resistance diminishes 10 % each time the load is doubled, we see that the figure specified of 18.7 kgr./mm² corresponds for 15 000 000 applications of load, to about 12.3 kgr./mm² (7.809 tons per sq. inch). We deduce from this that the stipulated figure, which at first sight appeared a very high one, is not overdone, especially if allowance is made for corrosion caused by rust.

In the course of our investigations, we subjected some fishplate joints to fatigue tests by way of comparison. These tests were only made for the purpose of obtaining some idea of the resistance offered by such joints, for it is evident that it is impossible, short of doing something more, to compare welded — and therefore rigid — joints with fishplate joints which are relatively flexible. It is not less surprising to find that there is a considerable difference between the resistance offered by the two kinds of joint. The simple fishplate joint does not even support statically the load that the welded joint must carry a million times. With the load reduced by 50 %, it failed after being subjected to load 160 000 times. The joint fitted with the angle-bar type of fishplate supported 2/3rds of the specified load only 54 000 times. The reinforced angle-bar type of joint (fig. 21) was subjected to full load and broke after 195 000 repetitions.

These results prove that the limit of resistance offered by joints welded by the « Sécheron » process is much superior to that of ordinary fishplate type joints, which however have always afforded a sufficiently high degree of safety. For this reason, there need be no hesitation in affirming that welded rail joints are absolutely free from risk.

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